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[OFFICIAL NOTICE.]

Third Annual Meeting, Texas Gas and Electric Light Association.

OFFICE OF THE SECRETARY,
GONZALES, TEX., March 11, 1897.

The third annual meeting of the Texas Gas and Electric Light Association will be held in the Menger Hotel, San Antonio, Tex., on Monday, Tuesday and Wednesday, the 19th, 20th and 21st days of April, 1897. The following papers will be read:

"The Commercial Efficiency of the Incandescent Electric Light," by Mr. H. L. Monroe, Dallas, Tex.

"A Means of Largely Increasing the Summer Sendout of a Gas Works," by Mr. J. C. Lord, Fort Worth, Tex.

"The Storage Battery as an Adjunct to Small Electric Light Plants," by Mr. W. L. Hall, Mexia, Tex.

"A Few of the Many Details of Management," by Mr. A. E. Judge, Tyler, Tex.

"Little Things," by Mr. W. E. Holmes, Austin, Tex.

"Operating Expenses of Electric Light Plants," by Mr. J. D. Oliger, Cleburne, Tex.

"Electrolytic Deterioration of Water and Gas Mains," by Mr. W. A. Fraser, Dallas, Tex.

A few other short papers may be read. The Question Box will be a special feature of the meeting, and it is hoped the Wrinkle Department will also prove interesting.

It is expected, and an effort is being made, to have an exhibit of gas and electrical appliances, which it is believed will be both interesting and instructive.

The last day of the meeting is "San Jacinto Day," a great holiday in Texas, and in San Antonio especially, when the "Battle of the Flowers" takes place.

Effort is being made to obtain cheap railroad rates, and everything will be done to make the expense of attending as light as possible.

The Secretary will take pleasure in sending blank applications for membership and information regarding the Association to those interested.

F. R. STARR, JR., Secretary.

BRIEFLY TOLD.

THE BROOKLYN (N. Y.) UNION GAS COMPANY'S STAND IN THE INSTANCE OF THE SLIDING SCALE CONTRACT.—Some time ago, taking the initiative under the provisions of the Wray bill, which permits the authorities of cities to enter into contracts with gas companies for the supply of gas on public and private account in such cities, for a term of years, provided that the rates agreed upon are lower than those existing at the time the agreement was made, and that they are to be successively decreased during each year of the contract period, offered a contract to the city of Brooklyn, the terms of which substantially and literally conformed to the Wray act. The specific terms of this contract have been printed in the JOURNAL, so it is not necessary here to repeat them, save than to note that the Company agreed to supply gas on public account, commencing (January 1st, 1897) at $1 per 1,000 for the current year, a concession of 2½ cents per 1,000 to be made each

year for the four following years, or until the rate of 90 cents per 1,000 was made, when the contract was to terminate. For the account of ordinary consumers, the rate in 1897 was to be $1.20, with a concession of 5 cents per 1,000 for each of the four succeeding years, or until the rate of $1 per 1,000 was reached. The Company submitted other graded propositions, on the basis of 1, 3 and 10-year contracts; but as the 5-year proposition was clearly the most advantageous to the city, that was the one which the Board of Aldermen, by a decisive vote, adopted. The ordinance and contract then passed on to the Mayor (Mr. F. W. Wurster) for his consideration. He refused to sign the contract, but he also declined to veto it, and in due time, under the local laws governing the case, the measure became a binding one on the city. Mayor Wurster did, however, say that he would sign it if the Company would agree, in case the present Legislature passed a bill cutting gas rates in New York and Brooklyn to a figure below that proposed by the Company, to forego the contract. This, very naturally and properly, the Company refused to promise; for it would certainly not be good business policy to enter into a contract that bound only one party. The Company finally obliged the Mayor to record himself positively in the premises, and he did so by refusing to sign it. The next step in the case was taken by the Company last week, when its officers issued notice to its customers that, in accordance with its contract with the city, the next bills issued by it would be made out on the basis of $1.20 per 1,000, and that each consumer would receive a further return of 5 cents per 1,000 on all gas consumed by him since January 1st; the bills on city account to be also made out conformably to the contract on that score. This action has aroused much comment in metropolitan gas circles, and not a few well-posted ones declare that the Brooklyn Company cannot, in case, say, the Legislature passes a bill this session reducing the price that gas shall be sold for in Brooklyn to $1 per 1,000, or to any other figure, successfully plead this contract as a bar to such reduction. Others, however, are equally positive the other way; and with the latter we wish to be numbered. Having given to the Wray measure close study, we here go on record with the assertion that the Brooklyn Company's action is unassailable, and that it is entitled, for the period of the recently entered into contract, to charge and receive the sums named in it for gas supplied at the prices named. And we so believe because the city, having agreed to pay on public account a less sum for its gas than is to be paid by ordinary consumers, has bound itself to permit the Company to receive a higher sum from a vast number of lesser users, the agreed upon sums in every instance being lower than those permitted by the laws of the State when the contract was entered into. The whole thing hinges on the validity of the Wray act; and as to its validity we have no doubt whatever.

A Correction.—In our report of the proceedings of the last New England meeting, during the discussion on the paper by Mr. Walter R. Addicks, on "Reports of Gas Leaks," etc., it is stated (p. 441, 2d col.) that Mr. Addicks, responding to a question by Mr. Woodward, as to whether it was the practice in Boston to use clear cement in making pipe joints, replied, "No; sand with the cement." This report quite reverses that which Mr. Addicks said. The practice in Boston is to use clear cement in making street main joints.

Notes.—The executives of the Texas Gas and Electric Light Association propose to have a creditable display of gas appliances at the meeting next month in San Antonio. Intending exhibitors should lose no time in making known to Mr. W. E. Holmes, of Austin, Tex., the number of square feet desired by them to display their wares (the exhibition is to be held in spacious quarters in the Menger Hotel, San Antonio, Tex.), and their goods should be shipped care of the San Antonio Gas Company, San Antonio, Tex., so as to reach their destination not later than April 15th. Exhibitors who cannot send a personal representative may depend upon it that the Committee in charge of the display will see to it that the goods are properly set out, and that the same will be returned to the railroad depots, subject to the sender's order. No charge for cartage of goods, from depot to place of exhibition and back, will be made.——The proprietors of the Otto engine works have purchased a plot of ground adjoining their present huge establishment at 33d and Walnut streets, Philadelphia, Pa., the dimension of the latest purchase being 100 feet by 120 feet. On this plot will be erected buildings suitably equipped for the manufacture on a scale larger than ever of the Company's well known types of gas engines for land and water service.——A pleasant and unlooked-for meeting happened in Passadena, Cal., about a fortnight ago, the parties to the encounter being Col. J. H. Armington and Mr. Austin C. Wood. Their friends will be glad to know that they are well and happy.——Mr. M. S. Frost, formerly well known in the gas busness, especially through his connection with the Consumers Company, of Chicago, died in Detroit, Mich., on the 13th inst.

[Prepared for the Journal.]

A Technical Analysis of Hydrocarbons, Vapors and Gases in Literature and Laboratory.—No. 2.[1]

By Dr. W. H. Birchmore.

Hempel's book appears, from the date of the preface, to have its place here. It bears date, in the author's preface, "Dresden, Dec., 1889," although it appears in English dress, in November, 1891. This makes it one year late in the English, as compared with the "Cantor Lectures," of Prof. V. B. Lewes; for as no notice of the German appeared in English it is but fair to assume that the notice of the *Chemical News* of the English edition was the official notice to the world that the just mentioned book existed. I shall, however, take the date of the German publication as the proper one, and, as seems from the context more than likely, assume that, in writing the notes for his "Cantor Lecture," Lewes had this book in mind, if not in hand.

"Hempel" is too well-known a book to need any extended discussion of its merits and demerits, but for the sake of accuracy the following is quoted—the discussion of the analysis of illuminating gas by the technical method is the matter in hand, and on page 225 this is given as follows: "The hydrocarbons are first absorbed by alcohol, the carbon dioxide with potassium hydroxide, then the heavy hydrocarbons with fuming sulphuric acid, then the oxygen with phosphorus; and, lastly, the carbon monoxide with ammoniacal cuprous chloride solution. The residue, which consists of methane, hydrogen and nitrogen, is measured, and then led back into the cuprous chloride pipette, and a portion of it taken for the explosion analysis."

Page 226: "The gas mixture is now burned in the explosion pipette. The gas is transferred to the burette and the total contraction is measured. Then the carbon dioxide is absorbed with potassium hydroxide, and, finally, the oxygen in excess is absorbed with phosphorus. This last determination is made, merely to be sure that a sufficient excess of oxygen has been present in the combustion."

Page 231: "The determination of hydrogen may be made more exactly by absorption with palladium. Yet many experiments have shown that the accuracy attained by making use of fractional combustion of hydrogen is not greater than in the above procedure."

Page 205: "If a more complete analysis of furnace gases is desired, the procedure is exactly the same as that given for the analysis of generator gases. Furnace gases usually contain only carbon dioxide, oxygen and nitrogen. All other gases are present in but very small amounts. In oft-repeated analyses the author, Hempel, has always found only traces of carbon monoxide, methane, and the heavy hydrocarbons."

Page 233: "*Generator Gas.*—In addition to the apparatus used for the analysis of illuminating gas a hydrogen pipette (generator) is here necessary. The manipulation differs merely as concerns the combustion of the unabsorbable residue."

Hempel (*op cit.*, pages 225 to 230) gives an analysis, apparently of Dresden illuminating gas, and of recent date, at the time of the publication; the analysis may be justly by the context assumed to represent his practice as late as October, 1889. Sutton has given nother (*op. cit.*, p. 453) apparently made in his own laboratory at Norwich, and with the McLeod apparatus. The scheme of examination is given as follows below, beside the Hempel scheme. It should be remembered in making comparison that the Hempel examination is made by the process called technical, over water, the pressure being constant and the volume varying and these variations measured, while in the other the volume is constant, and the pressures answering thereto, *i. e.*, the tensions of that volume are the measured items. This method is the better if "high science" is the thing pursued, but for simple determination of the quantities of the different ingredients there is more than a question if the Hempel scheme is not the better, although Hempel himself calls the other the "exact method." Personally I think that, within the limits of the two machines, the one is as good as the other; but no one should attempt the "technical examination" nearer than one in one thousand, and the reading of the "barometer tube" nearer than one-half a millimeter is, I respectfully submit, simply to deceive one's own self, *unless the tube has been calibrated and each five millimeters is known to be the same length as each other five millimeters.* This does not hold if the tube is left blank as it should be, and read by a cathometer from a distance. Under these circumstances the reading of the tube to a tenth of a millimeter, at least, is obligatory, and the thing to be watched is the uniformity of the temperature of the various parts of the apparatus. But, to return to the analyses. Amount of gas taken, 100 C.C.M.:

1. For No. 1, see Journal, March 22, p. 446.

Absorption Analysis:

		Hempel, Dresden.	Sutton, Norwich.
(1)	Rem'd by alcohol.....Vapors	0.7	
(2)	" caus. pot....CO_2...	3.4	1.772 per cent.
(3)	" $H_2S_2O_7$ .....C_2H_4 (?)	4.3	4.966 "
(4)	" phosphorus. O_2	0.0	
(5)	" pot. pyrogal.O_2....		0.142 "
(6)	" am. cu. cl...CO....	9.6	
	Explosion Analysis:		
(7)	CO.....		5.684 "
(8)	CH_4	29.8	38.122 "
(9)	H_2	49.6	46.952 "
(10)	Nitrogen, by difference.....	2.6	2 361 "
		100	99.999 "

At first sight these seem to be very satisfactory pieces of work, but a little examination raises doubts, and a little more confirms them. These analysis, as representing the filling out of an official schematic examination, are all that can be wished, but as representing the composition of the gas they are certainly at fault, and about equally.

Notes to the Analyses.—(1.) This may or may not be complete. The result is wholly one of the incidental composition, and not one growing from the nature of things. The absorption of hydrocarbon vapors by alcohol in the presence of water is not constant, either for the same vapor (*i. e.*, for the vapor of the same hydrocarbon) or for any series of them *en masse*. The doubt always remains, no matter how positive the assertion.

(2.) Was this all CO_2? In some illuminating gases there are unexplained absorptions, both by solid KOH and the same in solution, which suggest a gaseous acid of some sort. At least a dozen times in the spring of 1895 I passed large quantities of gas through reagents, proved the absence of the sulphur radicals and oxygen, passed the gas through $CaCl_2$, proved the absence of chlorine, and then into dilute air-free alcohol (2 per cent.) in air-free water, to which I had added a small part of methyl orange. The gas samples stood over mercury and out of the light, and yet in every instance the indicator gradually turned to the acid pink.

(3, 4, 5).—This is a pure assumption. If the hydrocarbons in the gas were C_2H_4 homologues alone this might be true, but as this fact may well be doubted (see quotations from Lewes' Cantor Lectures), the whole matter is *sub judice*. It is certain that Hempel's caution to pass the gas back into $H_2S_2O_7$, and then into KOH, after the use of the alcohol, should never be neglected before passing to the determination of the O_2, by phosphorus; but even with this precaution the phosphorus determination is not always satisfactory. For instance, in May, 1895, there were a number of days when samples of the illuminating gas of Brooklyn would show no oxygen to the phosphorus determination, while they showed it readily to the pot-pyrogallate reaction. Neither of the two should be taken as final, and, in the larger part of the cases, the two should be used before any opinion on the absence of oxygen from an illuminating gas is formed, much less expressed.

(6) The absorption of the CO by this reagent as opposed to the combustion analysis is all right if the residual gases are CH_4, H_2 and N, and no others, but this also remains to be proved. It is demonstrable by the spectroscope that not infrequently carbon is precipitated from the residues in a way which cannot but cause irritation to the analyst whose intention is other than to follow out a routine. Still further, accepting the Hempel method of fractional combustion of the H_2 as final, it is simply impossible, after the H_2 has been removed from the unabsorbable residues, to square the record on the assumption of CH_4 being the only gas left to burn. The unsatisfactory way of crowding all the error into the determination of N by difference goes without saying. Of course, when N is determined by "residue" there is no fault to find.

A few years before this appeared the most explicit statement of the components of illuminating gas that had ever been attempted, the so-often quoted one of H. E. Armstrong and A. K. Miller (*Jour. Chem. Soc.*, 1886, page 74). The composition given by these gentlemen may be expressed as follows:

(*a*) Paraffines. Traces only.

(*b*) Pseudo-olefines, or saturated hydrocarbons of the series $C_n H_{mn}$, such as occur in Russian petroleum, present in relatively small amount.

(*c*) Olefines, viz.: Ethylenes, propylene, normal amylene, hexylene and heptylene, higher homologues being absent.

(*d*) Pseudo-acetylenes, viz.: Crotonylene (di-methyl-enethane) and iso-allyl-ethylene.

(*e*) Benzenoid hydrocarbons, viz.: Benzene, toluene, the three isomeric di-methyl benzenes, the two tri-methyl benzenes (pseudo-cumene and mesitylene) and naphthaline.[1]

In 1891, beginning with the issue of the 9th January, the *Chemical News* republished the famous "Cantor Lectures," by Prof. V. B. Lewes, "As Reported by the Author." While not the first of the productions of this distinguished man, they mark a date in his development. At this time he is the champion of orthodoxy at all cost, and Prof. Frankland is the brand he would save from the burning; indeed, his lament over the said Frankland's persistence in his heretical belief is actually touching, in view of the opinions the said Lewes has since expressed on the illuminating values of sundry hydrocarbons, and the "acetylene question."

Apart from the importance of their author, these lectures have a value of their own; they contain a statement of the views held by a noted "gas analyst," the paid expert of many companies. They show beyond all question what Lewes thought at this time of the methods of analysis then in use, and of the assay schemes of the day. He lays a proper stress on the importance of using assayed air in the explosions analysis. This was a move in the right direction, and is still perhaps the best of all practically possible procedures. The use of the oxy-hydrogen gas was already a common proceeding, and the use of an oxygen obtained from the potassium chlorate dated from the time of Bunsen, but the use of the latter required the admixture of some inert gas, which air already contains, and thus complicated the questions involved in the analysis.

After expressing his opinion of the then methods he goes on as follows: "The nearest approximate result is obtained by treating the gas, first, with strong bromine water, but not leaving it too long in contact with it, and then removing the bromine vapor with sodic hydrate, the absorption being taken as the ethylene series; while the benzene is absorbed by fuming nitric acid, or saturated Nordhausen acid, acid fumes being removed in the sodic hydrated tube before measurement over water."

"Ethane, propane, butane, and a good deal of the methane," are then absorbed by paraffine oil. Balance is exploded, and the part absorbed by the oil and the calculated results of the explosion are taken as the methane series. A fresh portion of the gas is then exploded over mercury, with excess of assayed air. Carbon dioxide is absorbed with sodium oxyhydrate, oxygen, the excess, by progallate potash solution; while the residue is taken as the sum of the nitrogen of the assayed air and that in the gas is used to obtain the value of the nitrogen content of the sample.

By this arrangement of things the hydrogen and not the nitrogen is estimated by the method of difference, and while the error may not be greater it is capable of verification in the course of the analysis, if it is worth while.

The author gives an analysis by this method as follows:

"In this way an analysis of South Metropolitan gas shows—

(1)	H.....	= 47.9 per cent.	
(2)	Illuminants, C_2H_4 series....	= 3.5 "	approximate.
(3)	" C_3H_6 "	= 0.9 "	"
(4)	" CH_4 "	= 7.9 "	by absorption.
(5)	" CH_4 "	= 33.3 "	by explosion.
	Total CH_4 "	= 41.2 "	
(6)	.....Total hydrocarbons	= 45.6 "	
(7)	.....CO	= 6.0 "	
(8)	.....CO_2	= 0.0 "	
(9)	.....O	= 0.5 "	
(10)	.....N	= 0.0 "	

Notes on the Above Analysis.—(1.) It must be remembered that by this system H_2 is determined by difference; it therefore contains all the error. There is no possible reason why the method of fractional combustion should not be applied, and thus at once determine the error of the analysis, and the amount of the H_2.

(2.) This is made by the bromine method, and the criticism made by Treadwell and Stokes applies *a fortiori* here.

(3.) Compare with (3) in the Hempel analysis. In both cases $H_2S_2O_7$ is used, and in the Hempel scheme C_2H_4 and C_6H_6 are both taken up, while in this scheme the C_2H_4 is assumed to be alone. In this connec-

1. I make this part of the record, not because of its practical and technical value, but lest someone not finding it should think it omitted for cause. If anyone thinks a longer list of components desirable, he may look in "Thorpe's Dictionary" (1894), II., page 184, where he will find a list covering 100 items more or less.

tion see quotation from Thorpe, later on, in regard to the parting of these two substances.

(4 and 5.) The first of these items is by hypothesis, "ethane, butane, propane and a good deal of the methane." This statement and scheme decidedly lack precision.

(7.) How was the CO determined; in a fresh sample or after the above treatment? By the method set forth a large part of any one of three ingredients may be estimated as another, and yet we are to determine the process by which a gas is manufactured by an analysis made in this way.

(8.) The absence of CO_2 is noteworthy, but the gas has already been twice treated with reagents which would remove the CO_2, and no mention made of the possibility; is this science?

(9 and 10.) Does Prof. Lewes expect anyone to believe in the accuracy of a method of analysis that finds free oxpgen in an illuminating gas and *no nitrogen*? If average air contains 21 per cent. O_2, and it is certainly near this, then the amount of N_2 present to account for the O_2 could not have been less than 1.88 per cent., for the O_2 is given at 0.5 per cent. Yet it is asserted that the N_2 is a measured residue. Compare this with Hempel's analysis, which gives 2.6 per cent. N_2 to no O_2, which O_2 it is quite possible the phosphorus might have refused; and with Sutton's 2.361 per cent. In both these the N_2 is vastly in excess of the O_2, and in Sutton's case it can hardly be wrong, as the N_2 was directly measured as the residue. Without wishing to be unduly critical I cannot but think that Prof. Lewes should have done one of two things, either have worked out this analysis so that it would hold water, or else have been a little more full in his statements; in either case one might be able, by repeating his experiments, to understand his intentions, which I protest with the best of will I cannot do. I have tried again and again to follow this scheme through and it simply will not give results twice alike.

It is but fair to the author of this analysis to state his views so far as he expressed them on the value of this return. He disclaims any intention of offering the assay scheme as one for the use of those who would study gases simply for the sake of finding out the ingredients: but he affirms that by this scheme, for which he claims so little, much more, and more practically important matter, can be ascertained than by any other scheme at present in vogue. He further says that this scheme meets the need which is rapidly arising for a method to determine "whether coal gas enriched by cannel coal gas, carbureted with either gasoline or oil gas, or coal gas enriched by highly carbureted water gas was being dealt with." "In the first case the C_2H_4 group will read high in quantity, as will the C_nH_n group, while the CO will be comparatively low." "In the second case the CH_4 group will be increased." "If oil gas is used, CO might be increased;" with the use of carbureted water gas the CO is "brought up," and CH_4 "becomes important."

If it be true that no vague statement can justly be called learned, then Prof. Lewes did himself scant justice; for he should have set the limits where faith ends and knowledge takes its place. If by the use of methods and inquiries such as he hints at we are to determine the character of a gas, rather than by the statements of trustworthy men, who tell us they are making gas of kind "A," or of kind "B," then the sooner the whole business of gas analysis is dismissed to the limbo of the lost arts the better. But is not the whole trouble with this paper to be found in the fact that Prof. Lewes is a man of the schools, and for them; and that, like the rest of his class, he has forgotten that while the questions asked by those who consult him may in a way justify his attitude towards the questions, it can never be possible to justify his attitude towards the men? Prof. Lewes may know more about chemistry, but his audience certainly knew more about gas making. The theories of flame, and the theory of the illuminating value of acetylene, form no part of the subject of this paper; but it is impossible to ignore them in considering the statement that "this scheme of analysis gives a better idea of the value of the gas for technical uses than any other now extant."

The next notable contribution to the literature of this subject is to be found in Thorpe's "Dictionary of Applied Chemistry," 3d edition, Vol. I., p. 154. This article is one of the fullest, and I would strongly recommend it to the attention of all and singular who may be interested; there is no question but that it represents the best at our hands, and it may be summarized as follows: "Only those methods will be described which are available for technical purposes." This statement is of the utmost value; it marks the state of the technic at his date of publication, and is to all intents a record of what is and what is not, in November, 1894. He refers in a general way to the founders of the art and suggests the study of certain text books, describes the Hempel technical method, and then goes on to list the gases that can be determined technically, the reagents required to determine them, and the order in which they should be used. The word HEMPEL is written large over the whole of the article, but at the same time there is enough of the work of others incorporated with it to make it a really valuable record of the state of the art at the date given. The reagent list is as follows: Bromine, cuprous chloride in hydrochloric acid, same in ammonia. To these he adds the note that the latter can be used over mercury, which the former cannot. Hydrogen, oxygen, oxyhydrogen, for explosion purposes, come next. Phosphorus is given as a way of determining oxygen, but the limits of its use are not alluded to. Potash and soda oxyhydrates are the next mentioned reagents, but the fact that there is any choice between them in a scheme of analysis is not made clear. The pyropotash method for oxygen determination is the method of choice, as it certainly should be. The nitric acid intended, and also the sulphuric acid, are not so well explained as in the handbooks. Finally, he adds water to his list; but why not mercury also—it is as much a reagent in the premises as water and deserves as much attention as to fitness for the use? He also makes no mention of the alleged fact, which had just appeared again in the literature of this art, that water containing NaCl was almost inert to gases, if there was enough NaCl in the said water.

This list is followed by one of methods of estimation, as follows:

NH_4 is estimated by titration.

C_2H_4 series, and C_6H_6 series are estimated by bromine. Fuming nitric acid, or the Nordhausen acid $H_2S_2O_7$, to which direction is attached the important note: "And, in fact, no absorption method is at present known by means of which benzene and the olefines can be separated." In this connection it would be well to consult the original of the Berthelot method, which certainly does not agree with this statement.

CO_2 is absorbed by KOH, or NaOH, but no directions are given of any value for a choice between the two.

CO is to be absorbed by the am. cups. chl.

H_2 is estimated either by the combustion by oxygen or by the palladium method, but the distinctions of when and why are not made clear.

HCl and SH_2 by titration; the arsenic method of estimate of SH_2 is not alluded to.

$C_nH_{xn+?}$ are estimated by combustion. There is neither hint nor allusion to show that Lewes has ever existed for Thorpe.

NO is titrated, or estimated by combustion.

O_2 is estimated by measure, KOH and Pyro.

SO_2 is titrated.

Hempel's important distinction between the suspended vapors and the gases, that the first can be abstracted by alcohol which does not affect the latter, is not recognized.

An ordo is given which plainly assumes the use of only one sample, after the Hempel method, and is constructed rather in the interests of rapid work than of scientific investigation. It is as follows: CO_2, C_2H_4, C_6H_6, O_2, CO, H_2, CH_4, N_2. This last is taken by residue or difference, as the analyst chooses; no hint of the method by the use of the assayed air is given. Is it regarded as a useless refinement?

This closes the 20 years, from 1875 to 1895, and gives one an idea how much the technical analysis of gases had advanced in that long period. With the advent of acetylene as a commercial possibility, and the conviction that the electric light did not stand for the total damnation of the gas interests, a new era of advancement seems to have begun; there is much to show that the technical scheme has been recognized as insufficient, and that before long in some way an official method will be required which shall bring the technical and scientific examinations nearer together. Hints of such a happy condition of things are more frequent in the American than in the English and Continental journals, perhaps because the American chemists are less hampered by official interference, perhaps from simply "Yankee restlessness at the condition of things which be;" but at any rate there is evidence that in this country at least a better technical method than any of those in literature is gradually being developed, not by one, but by many workers, and that before long we shall have some way of bringing about an answer to the question, "What have we here?" before we set to work to determine, "How much of it have we?"

THE Payne Engineering Company, of New York city, with a capital of $10,000, has been incorporated to manufacture gas engines. The Directors are: S. H. Payne and N. B. Payne, of New Brighton, S. I., and A. G. Duncan, of New York.

[Prepared for the JOURNAL.]

Street Main Bookkeeping.

By MR. GEORGE F. SUMMERS, M.E.

The primary object of every gas plant is the ultimate maximum dividend. This is accomplished either by increased receipts or diminished expenditures. In the present paper the latter feature is considered in the detail of saving in distribution labor by good methods of recording information concerning the street mains.

The first step in determining the system of records for any works is to fix upon the smallest amount of recorded information with which the plant can be safely and comfortably managed; then, by simple and direct methods, this should be conveyed from the street to its final resting place in the office. The following system is presented as being economical and satisfactory in every respect.

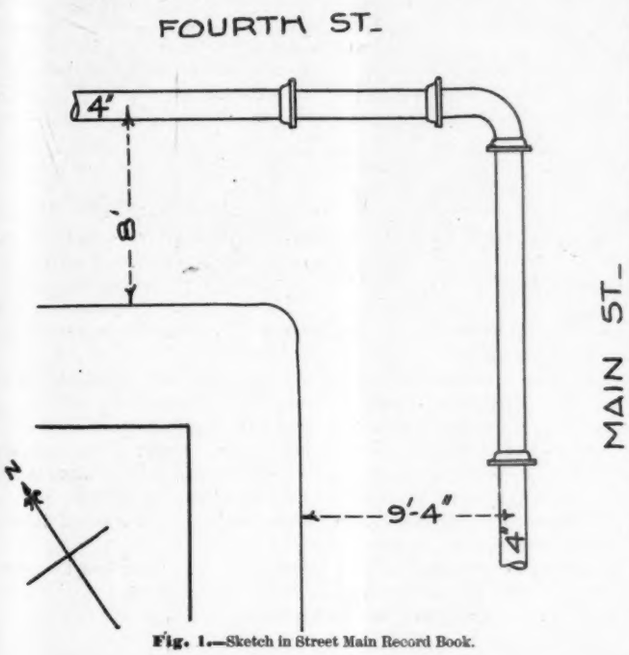


Fig. 1.—Sketch in Street Main Record Book.

For proposed new services and extensions a manager will want to know in a general way on what streets he has pipes, as well as the side of street and size of pipe. He may want to know the distance from curb, depth, length and cost of main, the nature and location of specials, bells, valves and drips.

The distance from curb, nature of specials and location of valves and drips is best shown by a series of drawings at a large scale (about ¾ inch to the foot, the drawing being not made to scale), the details being all large and clear and the measurements from the curb or other convenient objects being marked boldly in figures. (See Fig 1.) These

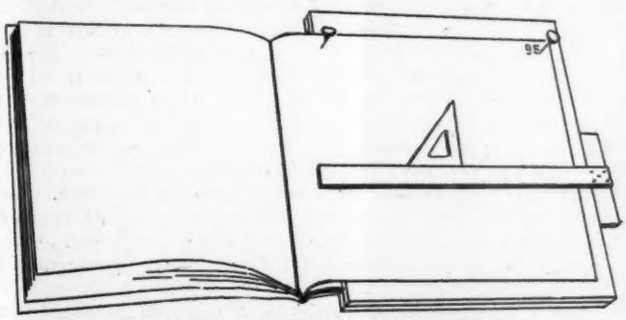


Fig. 2.—Showing the Method of Using Record Board.

drawings should be made in a book, and should not be restricted to pipes in the ground, but also to contain any small sketches the superintendent wishes to preserve. For mains it will be usually sufficient to make sketches of the specials only with the adjoining pipes. A record board should be used; this is best made up at the planing mill. It is a light board, of ¼ inch poplar, unvarnished, fitting under a page, as shown. (See Fig. 2.) The cleat on the board trues against the edge of the book cover. The page is held in place by record pins, made from No. 10 sewing needles, whose heads have been softened in a gas flame and tipped with a sealing wax button. These will not mutilate the page like thumb tacks. To make the drawings quickly, especially for those who are not draughtsmen, rubber stamps are used to show the specials, the pipes being put in afterward with a drawing pen. By partly cutting off the impression with a piece of paper any combination can be shown with the stamps given in the cut. (See Fig. 4.) The book itself should be about 12 inches by 14 inches, and contain 100 leaves (in this case 100 pages) of a good bond paper. This book should have thin canvas covers, in order that it will be durable and not take up too much room in the safe; also, so it will be convenient to handle and not break from its own weight in falling, and yet be large enough to show at a comfortable size the matter required. The numbering of the pages of the first book, from 0 to 99, and the second from 100 to 199, enables the number of the book to show the page numbers contained. For example: Book No. 0 would contain pages up to 99; book No. 6, all the six hundreds.

When a pipe is seen uncovered the record is best made at the time by the man seeing it, preferably not by a laborer. The book for this record, the pocket sketch book, should be just large enough to fit comfortably in the side coat pocket, should be thin and light, of good bond paper, covered with leather, not canvas, and contain about 100 leaves. Both this and the street main record book are best made to order, as the right paper does not come in books already made up. The information taken in this book should be the permanent and final record, except where more or less shorthand notes are taken for the basis of drawings in the street main record book. Rather than measure a run of pipe, measure one or two lengths in the trench as they lay, and multiply by the number of lengths, adding the short pieces and specials for the length of the main. This length is needed for the leakage and cost per foot. The location of bells is wanted in barring for leaks. In the sample pages shown, the pipe has been laid on Chestnut street, from Fifth to Sixth (North being at the top of the page), and the record here taken in the pocket sketch book forms the only record kept of this information. (See Fig. 3.) If the intention had been to make the sketches

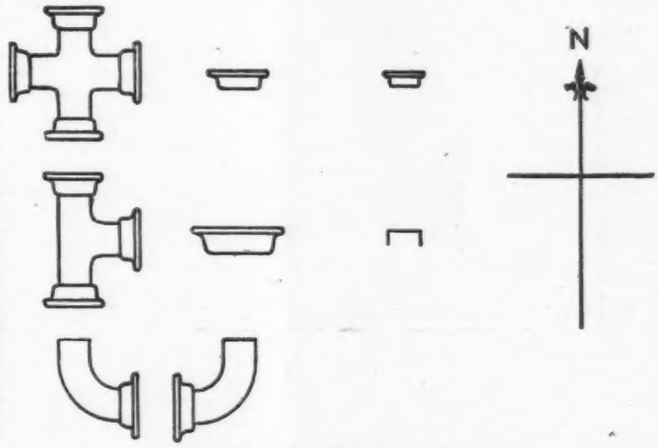


Fig. 4.—Rubber Stamps. Actual Size.

in the street main record book, the sketches should not be made as elaborate as are here shown, but just a few marks and figures put down to aid the memory when back at the office writing up these notes.

A book should be set aside as a main ledger (a street main record book, ruled up by the printer before binding, will answer very well), the mains being grouped according to size. The debit and credit sides of this ledger should represent the mains taken up and laid. The information recorded in this book is for any one main laid; the street, side, location of ends and length; the cost per foot of labor, pipe and specials, lead, yarn and sundries, paving and total cost per foot; and total cost, arranged in tabular form. The first part of this information is wanted to identify the main and to keep the correct mileage, the second to estimate for new work.

The general information is conveniently obtained from a map, which can be made of tracing cloth; a lithographed map can usually be obtained, from which the new map can be directly traced. The scale should be about 300 feet to the inch; a smaller scale makes it difficult to enter new mains; with a larger scale the eye does not cover enough territory, as well as making the map unwieldy. The map itself should

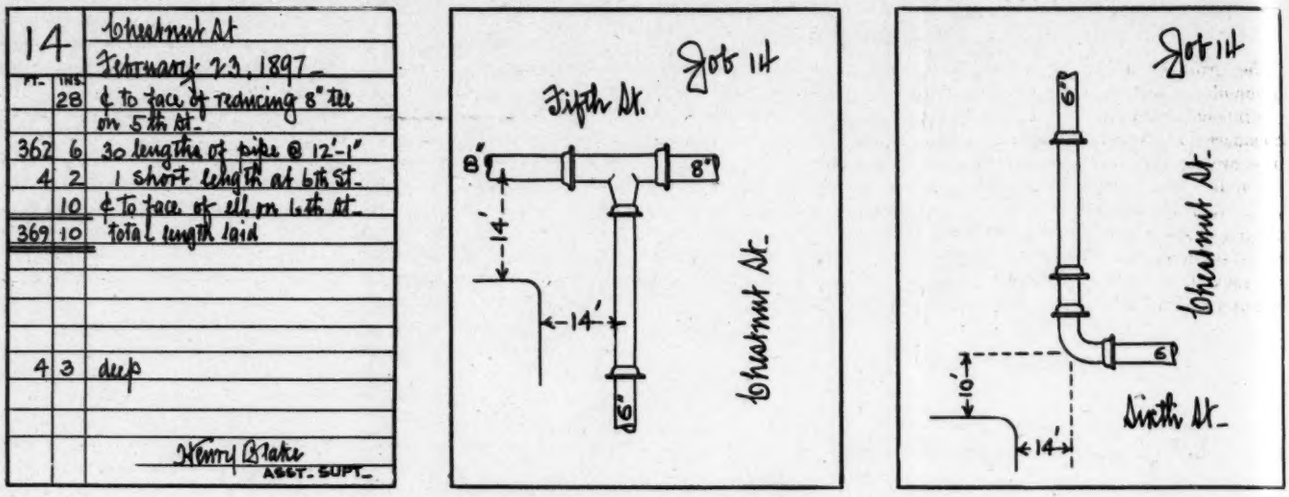


Fig. 3.—Pages from Pocket Sketch Book.

contain the outlines of the blocks, with the street mains inside the property lines, leaving the streets clear for the mains. The mains may be represented by lines. The inks used should be waterproof drawing inks. The reason for this being that, as writing inks and tracing cloth are both transparent, the light passes through both and we see neither plainly; writing ink also will blur in time, especially when worked over with moist hands. A convenient system is made by representing 2-inch pipe and under by black, 3-inch to 6-inch by carmine, 8-inch to 14 inch by light blue, 16 inch and upwards by green; starting with a solid line, then a broken line, a dash and a dot, a dash and two dots, and so on upwards. The map should also be used as a finding sheet for the detailed drawings in the street main record book. That is, whenever a sketch is made of a piece of main, its page number should be entered on the map, a "V" or "D" will indicate a valve or drip.

The service information is so large that it is good form to use a library card index to save room. The cards should contain information written by the street foreman and be the final record. It is a good plan for the foreman to make pencil sketches on the backs of the cards.

The drips and valves are known to all the men in a practical way. Keep in the street main record book for reference a sketch of each valve and drip. Other books are unnecessary. When a man cannot find a drip let him consult the street main record book and take the measurements out on the street on a slip of paper.

The cost to start this system in a town of 15,000 population is as follows:

Lithographed map	$10.00
Tracing cloth map	50.00
3 street main record books, at $2	6.00
10 pocket sketch books, at $1.50	15.00
Record board	.30
9 rubber stamps, at 8c	.72
1 16-inch tee-square	.30
1 No. 5 triangle	.25
1 drawing pen	.75
1 bow pen	1.50
Street main ledger	3.50
Service card filing cabinet	25.00
4 bottles drawing ink	1.00
	$114.32

While these small details are generally considered beneath the dignity of a paper of this kind, I believe they will afford satisfaction to the superintendent; the prices are all above those paid by the writer during the last five years.

In general for satisfactory record keeping: Make as few entries as possible and make them the permanent record; avoid repetition under all circumstances; do not attempt to record too much; make the information you do put down clear and bold; trust considerably to your memory for one day, but have the information in writing before the next morning; do not allow the men to keep private records.

The Use of Atmospheric Air with Lime for the Purification of Coal Gas.

By Mr. S. CARPENTER, of East Ham, Essex, in the London *Journal*.

Questions having at times arisen as to the use of atmospheric air where lime is employed for the purification of coal gas from carbonic acid and bisulphide of carbon, I should like to offer a few remarks upon the matter, not with the view of instructing gas managers, but at the same time in the hope of benefiting some of them.

My advice to all who are interested in this subject is: (1) Do not allow any atmospheric air to pass up the ascension pipes or go into any part of the hydraulic main. (2) Do not admit any air at the inlet of the condensers. (3) Do not allow air to get into the lime purifiers under any consideration; for if any should be admitted, it will interfere with the chemical action of the lime and the gas. The air oxidizes the hydrogen of the sulphureted hydrogen, and sets it free, and at the same time fixes the sulphur in the lime. The air acts in precisely the same way on the gas in the lime purifiers as it does on that in the oxide of iron purifiers. If air is admitted into the purifiers to the extent of (say) from 1½ to 2 per cent., the lime is converted into pure sulphide of calcium, which has very little affinity for bisulphide of carbon. It must be converted into what the writer terms "hydrogenated" sulphide of calcium, which has in a high degree the power of absorbing that stubborn impurity bisulphide of carbon from coal gas. This impurity, or at any rate part of it, can be easily removed from coal gas if the lime purifiers are worked in the way the writer has described in his pamphlet on the "Purification of Coal Gas."

If air or any furnace gas, or the gas at the end of the charge where anti-dips are used, should be admitted into the lime purifiers, especially just before a box is thrown out of action, it will drive out of the lime the impurities which this material had previously extracted from the gas, and drive them forward into the gas which is being made. The air will act upon the lime in the purifier at work on the same principle that it acts on the lime in the box which is out of action for the revivification of the spent material it contains. These are the impurities which are given off when revivifying the foul lime. At the outlet of the purifier we get carbonic acid and sulphureted hydrogen. (These were the only tests the writer could make.) These impurities are passed into a small vessel charged with oxide of iron, so as to purify the air which had been contaminated with them when passing through the foul lime.

If at any time the chemical action of the lime should be interfered with—for instance, by an excess of air or furnace gas—there will be a very considerable rise in the sulphur compounds other than sulphureted hydrogen; and from the results of the sulphur test, instead of getting a white powdery ash in the crucible, there would be small flakes of sulphate of barium—showing that the chemical action of the lime had been interfered with by something more than the sulphur in the crude gas. In the event of any interference such as has been stated, this is very probably the condition in which the lime would be

in the purifier. Instead of being sulphide of calcium, we should obtain calcium sulpho-carbonate ($CaSC_3$); and by passing the gas through this, we should get into it thiocarbonic acid (also called sulpho carbonic acid). To prevent eruption in the sulphur compounds other than sulphureted hydrogen, do not admit any atmospheric air, directly or indirectly, to pass into the lime purifiers. Then the bisulphide of carbon in the gas will keep to about 10 to 15 grains per 100 cubic feet of gas, and there will be no trouble with the lime purifiers.

The writer has worked these purifiers for thirty years in the way described in his pamphlet already referred to, and with good effect. The following are some of the first results of the tests for sulphur in gas which had been purified in large purifiers by lime for carbonic acid and bisulphide of carbon in 1866:

	Grains S. per 100 Cu. Ft.		Grains S. per 100 Cu. Ft.
November 10.....	16.48	December 1.....	15.00
" 13.....	19.08	" 2.....	15.27
" 14.....	14.17	" 4.....	13.67
" 15.....	14.06	" 5.....	14.03
		" 6.....	16.03

There was no carbonic acid in the gas.

The following are the results of tests made in 1867:

	Grains S. per 100 Cu. Ft.		Grains S. per 100 Cu. Ft.
June 9.....	12.21	June 15.....	14.28
" 10.....	9.72	" 16.....	16.89
" 11.....	9.30	" 17.....	16.50

There was no carbonic acid in the gas.

The writer worked lime purifiers from 1866 to 1896 in precisely the same way, and good results have been obtained in purifying gas from carbonic acid and bisulphide of carbon. There was no carbonic acid in the gas, it having been all taken out by the lime in the first purifier.

The only place where atmospheric air can be used without interfering with the purification of coal gas, where lime is employed for decarbonating the gas and removing part of the bisulphide of carbon, is at the inlet of the first oxide of iron purifier. From 1 to 1½ per cent. of air admitted there will be sufficient to keep the oxide in an active condition. As the result of practical experience, the writer has found that when the sulphureted hydrogen makes its appearance on the top of the first oxide purifier, it is a good thing to pass a small quantity of air in at the intlet of the second purifier. If the air is used in the way described, the oxide will last in the purifiers for months instead of weeks. When preparing the oxide for the purifier, do not put it in too wet. If it is in this condition, it is very inactive in the removal of the sulphureted hydrogen. The writer has found this by practical experience: When passing the air directly into the lime purifiers, the oxygen did not reach the oxide of iron purifier, so that the material did not derive any benefit from the air. When the purifier was opened, the oxide was wet, and very little discolored, and this on the bottom tray; while the material gave off a strong smell, resembling that of acetic acid. The object of sending air directly into the oxide purifiers is to keep the material in a semi-rusty condition.

The Early History of Cast Iron Pipe.

At one of the meetings of the New England Water Works Association, Mr. Jesse Garrett, of Philadelphia, dealt with the history of the manufacture of cast iron pipe, from which the *Bulletin* has culled the following:

Cast iron was known to Holland in the 13th century, and stoves were cast at Elass in 1400. But tradition has it, which an ancient Roman writer records, that the temple of the "Great Mother," at Sparta, is said to have been built by Theodorus, who first discovered the art of casting and making statues in iron. All this is necessarily vague, a condition which suggests a quotation from Dr. Greene, of the Boston Historical Society, in reference to the present disturbance of King's Chapel burying ground for the subway human conduit. "It is so full of bones and remains that I do not believe you could dig down to the depth of much more than an inch without turning up the dust of ancient worthies." The application is this, that in the dust of these "ancient worthies" it is impossible to verify the individual instance. As with the metal itself, so its discovery in the form of cast iron was an accident which occurred at one of the early iron works in the Rhine Provinces, where a part of the "running" one day was found to be of different texture, and it was a problem for some time what to do with the strange stuff.

The first blast furnaces appeared in the Thuringian Mountains, which were almost identical in principle with the present furnaces, with the exception that hand or treadmill bellows were used for the blast, from which the present mechanical blowers are an evolution. In 1377 the first cast iron gun was cast in Erfurt, and the famous Krupp was casting guns in 1818, so that it appears iron was mostly used for destructive and not Samaritan purposes through many centuries of its history. In 1685 the first cast iron pipes were used for the water service of Versailles, followed by screwed and flanged pipes. In 1708 the Quaker, Darby, patented the system of box casting, and in the following year started the famous Coalbrookdale Foundry, which in 1780 turned out the first cast iron bridge. The first casting in the United States is said to have been made at Lynn, Mass., a cast iron pot, which was exhibited at the World's Fair at Chicago.

In the region of Alba Longa, buried by the volcanic eruption which drove the Albans to the present site of Rome, no trace of iron is found, and its absence is still notable in the archaic tombs of Rome. The metal for their implements, of whatever kind, was of bronze, and the early Roman religious sentiment shows such an abhorrence of iron as to make it a profane innovation to use it in almost any form, especially in and around their sacred temples. This superstition continued after the Christian era, even down to the fall of the empire. In their religious rites, if iron had in any way approached a temple or shrine, sacrifices were instituted to expatiate the profanation, so that we can hardly wonder that their attention was not turned to it as a substitute for lead pipe. When iron tools came to be used for engraving, and were so employed on certain altar inscriptions, penitential sacrifices were afterward offered by slaying a cow or a sheep on the altar. Bronze plows were used long after the introduction of iron plows. The high priests of Rome would not shave or have the hair cut with iron instruments.

The first mention of iron pipes I find was in an elaborate system built at Marli, near Paris, and set to work in 1682, costing $1,500,000. The account says: "They drew the water by short suction pipes from the river Seine, and forced it through iron pipes up the hill. They climbed to a height of 533 feet by a series of reservoirs and pumps, but this system came to be known as a 'monument of ignorance,'" probably after cast iron established confidence as a pressure pipe. Agricola makes no mention of cast iron pipes, although he shows 3-legged pots of cast iron. Ranselli, about the same period, describes a hand mill of a portable character, whose casing, he says, is made of iron, and its form and ornamentation are such that there is little doubt it was made of cast iron.

Peter Maurice, a German engineer, in 1582 erected, under the arches of London Bridge, 16 pumps, 7 inches in diameter and 30 inches stroke, driven by a water wheel, and these were of cast iron, flanged at their lower end, bolted to a valve chest.

In 1835 it was estimated that over 1,000 miles of iron pipe were in use in the various systems of London water works, the first iron pipes having been laid in 1746. Later on we find that cast iron pipes, 9 feet in length and 15 inches in diameter, with ball and socket flexible joints, were laid by James Watt across the Clyde for the conveyance of water to Glasgow, and another of the same size in 1818, and a little later on another of similar construction of 36 inches diameter.

Contemporary with the history of cast iron pipes in America is Peter Adams, a molder and core maker, born in Millville, N. J., in the year 1833. His grandfather, James Adams, was a soldier in the Revolutionary War. His father, Mark Adams, was born in 1789, and was a molder and core maker at Weymouth, N. J., where he was engaged on the first cast iron pipes made for the city of Philadelphia, from designs and under the instruction and inspection of Frederic Graff, first, who was the then engineer of the Philadelphia water works, and father of the later Graff, who succeeded him in office. The first pipes made for Philadelphia were for the pumping main, of 16-inch diameter, delivering into the reservoir, the distribution still continuing throughout the city through wooden pipes. These pipes were cast direct from the melting of native bog ore, and the process was about as follows: In the beds where pigs were usually run were molds for pipe, which tapped the flow from the furnace until one pipe was complete, then on to another mold, and so continuing for as many pipes as were planned for that pouring, using the surplus from the pipes for pigs as usual. The proprietor of these furnaces at Weymouth was a Mr. Richards, a native of the city of Philadelphia and its Mayor at that time. After this, Mr. Adams thinks that the first pipe made at Millville, N. J., was about the year 1830, the inspector for which, under Mr. Graff, he remembers as one Louis Ort, who "was a good fellow enough, but inclined to be very particular unless he got one or two glasses of whiskey before beginning his daily inspection, in which case it was very seldom that he would reject a good pipe."

The first pipe made at Millville, as at Weymouth, were from the product of the bog ore furnaces, and at that time, of course, cast upon their sides, a series of gates, six or eight in number, used for running the iron from the furnace into the pipe molds, which, at the proper time, were cut off and the flow of iron continued to another series, or to the pigs, as the case might be. As time went on, and the demand for cast iron pipes increased, and sentiment ripened against using the melt direct from the ore, the proprietor of the Millville works, David Wood, designed and constructed special foundries for their manufacture. The original proprietor of the Millville Iron Works, as before stated, was David Wood, a brother of R. D. Wood, who succeeded him, and who afterwards added to his pipe works from time to time until their production became the largest in the country.

The Selection of a Power Plant Steam Engine.

We are indebted to the *Electrical World* for this abstract of a lecture on the above subject, delivered by Prof. Hutton, of Columbia University, at a recent meeting of the Electrical Section of the American Institute, in conjunction with the Henry Electrical Society, at the rooms of the American Institute, No. 111-115 West 38th street, New York.

Three questions were particularly considered. The arguments for and against high and low speed engines, automatic cut-off engines as contrasted with throttling engines, and the arguments in favor of condensing engines. The lecturer did not have time to discuss compound engines, as was intended. The principles underlying work and heat motors and a thorough explanation of the well-known formula $HP = PLAN + 33{,}000$ were discussed.

With horse power fixed, both A (piston area) and L (length of stroke) would diminish as N increases. Engines embodying this feature are named high (rotative) speed engines.

Such engines have a small cylinder volume, because they are frequently filled; they also have small cylinder lengths and diameter, which make the engine light.

The small cylinder lengths make a short engine, because the crank and connecting rods are correspondingly shortened. The small diameter of the cylinder, however, increases the strain on the piston rod and connecting rod, and lightens them. The diminished weight of reciprocating parts secures a steadier and quieter running without increasing the initial pressure. Summing up the above points, we may say that the weight and bulk of the engine are diminished. The horse power can be increased without decreasing the weight and bulk by increasing the pressure.

High speed engines can be run with less change of speed ratio in the transmission, and, in fact, in some cases without transmission gearing, being direct connected.

When the engine speed exceeds 120 strokes per minute, each revolution is made in less than one second. The variation, therefore, in effort or resistance is more promptly met and adjusted to secure constant speed. The variation of effort and resistance has not sufficient time to get far away from the mean effort of the minute before a readjustment occurs.

The regulation and governing mechanism by which the effort of the steam and the resistance are adjusted to each other does its work more promptly in a high-speed engine than where it derives power from masses of more weight at less velocity. The heavier masses are more sluggish from inertia and have more friction from their weight.

The term "high speed" has been generally used in the sense of high speed of rotation, and not necessarily in the sense of high speed of piston. If L and N (number of strokes per minute) be increased together, but not N alone, there results a design of engine of small diameter of cylinder, but of relatively long stroke. Of this type of engine the Corliss stands as a prominent example in stationary practice. Here N is kept low on account of the valve gears. The typical beam engine used in river boat practice and also pumping engines are other examples of this class of engine, which are generally known as slow speed engines. The arguments in their favor are the arguments to be used against the high rotative speed engine. Some of these features are as follows:

Increasing L relatively to A and keeping N low diminishes the loss of cylinder condensation.

The clearances do not have to be as large.

Port areas can be cut down because the linear velocity of the steam is less.

The last two features diminish clearance waters, less steam being lost per stroke, and there are fewer strokes.

In the high speed engine with short traverse, all bearing surfaces are traversed more frequently and the weight is concentrated over a smaller area. Close attendance and excessive lubrication are therefore required, and the workmanship of such engines must be of a particularly high standard, making them costly.

When an accident happens to a high speed engine, the high speed in many cases prevents any possibility of prevention.

In summing up these various features the result would seem to be that if close regulation, light weight and direct connection are worth most, high rotative speed should be used, but if economy, long life and peace of mind are worth most, then the long stroke, slow speed engine should be used.

A piston speed below 500 feet per minute may be considered low; from 600 to 800, moderate; and above 900, high.

Some automatic governing device must be provided to meet the demands of varying load on the engine. In general practice this is accomplished by throttling the steam supply or by a variable steam cut off valve. The mean steam pressure on the engine cylinder is the only variable quantity that can be controlled practically.

The diagram of effort in the cylinder is shown by the indicator diagram. The energy of the steam expended in the engine is represented by the area of the diagram. The variation of height in this diagram shows a variable initial pressure such as would be produced by throttling. In such cases the steam cut-off remains constant and such engines are known as throttling engines. Automatic devices may be used to operate the throttle or it may be operated by hand.

The area of the diagram can also be varied by varying the cut-off at various points of the stroke. That is, the length of time during which the maximum pressure is maintained. In such engines the valve controlling the steam inlet to the cylinder is made variable so that at low loads the steam is cut off at a very small percentage of the stroke, while at larger loads or full load, the valve remains open for some time.

The advantages in favor of throttling engines may be enumerated as follows:

They are cheap to build and to buy; the valve gear may be exceedingly simple; the steam follows with maximum effort for a long distance and is less irregular.

Superheating and drying of the steam occurs when the high temperature steam suddenly finds itself at a lower pressure, as occurs when throttling is resorted to. This produces less cylinder condensation than where the automatic cut-off is used.

The disadvantages of the throttling engine are as follows:

They are less sensitive to instantaneous variations; they do not regulate as closely; the exhaust carries away more heat because the maximum has lasted through a comparatively long portion of the stroke and therefore a lower efficiency results from the steam used.

The advantages of the variable cut-off engines are as follows:

The steam effort is controlled at each stroke, and keeps the speed quite fixed.

The full boiler pressure acts without waste of energy upon the piston and without loss from friction due to throttling.

Superior economy is possible with such engines from less weight of steam than would be used in the throttling engines.

Among the disadvantages of the variable cut-off engines are the following:

As the maximum pressure in the cylinder is always at one point, wide differences of energy exist between the two ends of the cylinder. Heavy flywheels are therefore necessary with resultant increased friction.

The valve gear of such engines is usually complicated, making the engine costly to build aside from the necessity of superior construction in the other elements of the engine.

The low final temperature or pressure of the exhausting steam in the cylinder increases the cylinder condensation.

In some cases the expansion is more than complete, necessitating negative work.

In a condensing engine devices are provided for creating a vacuum in an exhaustion chamber into which the steam from the engine cylinder passes. By this method the atmospheric back pressure is eliminated and the effective pressure of the steam is therefore greater. Other advantages of such engines are:

Smaller cylinder for same power; complete expansion from same initial pressure and yet earlier cut-off and less steam per stroke from short admission; less heat is rejected at the exhaust; a higher efficiency is possible because the final temperature of the exhausted steam is less.

Condensation gives pre-heated water for boiler feeding, as the latter must be used in most cases for condensing the exhausted steam in the vacuum chamber.

Amongst the disadvantages of condensing engines are: The cooling of the cylinder by a lowered final temperature makes øh increased initial condensation.

The apparatus to maintain the vacuum in the exhaustion chamber is usually complicated and necessitates power for its operation.

When the exhaust steam is returned to the boiler, trouble frequently occurs from oil therein which should be entirely separated from the water before the latter is fed to the boiler.

The condensing engines are usually limited in their application to places where cooling water can be had in large quantities.

Such engines are generally operated at low rotative speed, which is limited by the condensing appliances.

The compound engines were not considered for lack of time. The lecturer hoped to consider this subject at some future date.

Incandescence Gas Light and Sight.

The *Lancet* says that some interesting discussion has taken place of late in regard to the effect upon the eye of the Auer incandescent light. The mantle of this incandescent system of lighting consists, as is now pretty generally known, of a network of the rare oxides (chiefly of thorium with a small proportion of cerium), which on being heated in the Bunsen flame emits a brilliant white light. As might be expected, this light is comparatively rich in the ultra-violet or chemically active rays that are identical with those in sunlight, and it has been urged that this richness in actinic rays may possibly be productive of injury to the sight.

This argument appears to be based on measurements of wave lengths made by means of the spectroscope. The arc electric light, it is said, has similar effects, but of a more pronounced character. As yet there is no evidence of experience, as far as we know—and the Welsbach light has now been in use for several years—that the slightest injury to the optic mechanism, where the system has been in use for domestic lighting, has ever been produced; and unless a person deliberately stared at the naked light for some hours every day it would be surprising to learn that real injury could be referred to this cause. It is well known that the radiation of light downward from the incandescent mantle is feeble, so that without a reflector or some reflecting surface at the top of the mantle, as in the ordinary way would be provided by a ceiling, much of the illuminating power would be lost. From the particular point of view under discussion this is, however, an advantage for the lighting of rooms, since reflected and not directly transmitted light is pleasanter and more agreeable to the eye, besides which in the phenomenon of reflection partial absorption takes place, so that the light becomes pleasantly diffused and of a healthy tone. In any case, if any apprehension should exist that the rays proceeding from an incandescing mantle are injurious because of their chemical activity—an activity which in sunlight gives life to the plant world—these rays could be readily and effectually filtered out by the simple expedient of surrounding the light with a tinted globe, such as red or orange, which need reduce but very little the originally high illuminating power. Even then the light is over 100 per cent. higher in illuminating value than the ordinary gas flame. Artificial light, of course, is most in request in the dark days of winter, and in that season, at the best of times, we receive but little more than eight hours' light from the sun, and then frequently it is largely filtered from its chemically active rays by the medium of a murky atmosphere. On the other hand, we enjoy in the summer just twice as much sunlight, which is then of greatly increased power, and the chemical activity of which is infinitely greater than could possibly be furnished by any known form of artificial light. Taking these simple facts into consideration we should almost expect to find in some form or other some manifestation of deterioration in the eyesight during the summer period, due to a largely increased exposure to the chemically active rays of solar light. We are not aware that any such manifestation has been observed. The argument that nature intended us to rest from the effects of light as soon as the sun is below the horizon demands, if it can be reasonably applied at all, the rejection of all artificial means of lighting, since there can be no light of any kind of any aid to the eye whatever that can be without some chemical activity. Still less practicable does such a suggestion become when applied to the lands of the midnight sun and other places, or to the arctic winter of several months' darkness. Clearly this theory could only be prompted by the consideration of the limited conditions of environment in the temperate zone. No men probably are exposed more freely and continuously to the chemically active rays of the sun than our sailors, yet their acuteness of vision and penetrative power of sight is a matter of admiration and wonder to everyone. Sunlight is by a thousand circumstances widely and uniformly diffused, making it more acceptable to the eye, and during its journey to earth it undergoes an important modification, for in passing through the air it is deprived of some of the red rays, while the blue rays pass on—a circumstance which explains the azure character of the sky. In view of these facts, it is difficult to receive the theory with any seriousness that because there may be a certain proportion of ultra-violet rays in a given artificial light it is necessarily injurious. It would be a sorry thing if these same rays were forever filtered out of the light of the sun by the medium of constant fog or cloud, as so often happens in the days of winter. Exposure to a purely elementary light, as red, yellow or blue, does undoubtedly prove injurious either positively or negatively. The distress produced on working for some time, to quote one instance, in a red or yellow light, as in the dark room of the photographer, who employs one or other of these colors on account of their chemical inertness, is well known. Absence of sunlight is held to be synonymous with the absence of life, and the life-giving and invigorating qualities of solar light are largely, if not entirely, dependent upon the chemically active rays, and certain lines of scientific research have shown that without the phenomenon of isolation going on day by day life would be unendurable and finally extinguished. White light, therefore, as afforded in its entirety by the sun, is a necessity of existence.

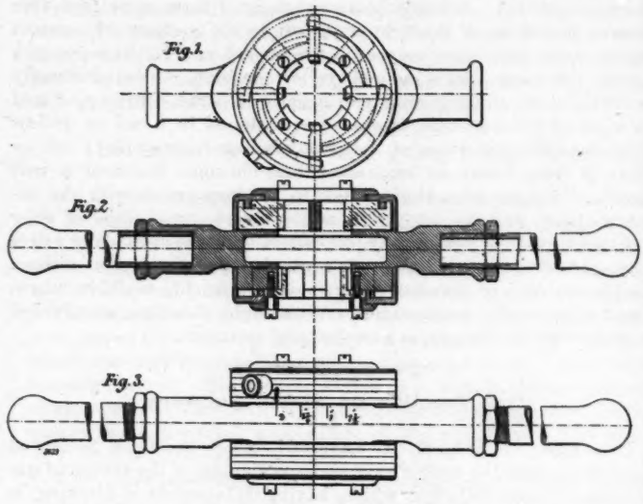
Gas Traction on Street Railways.

In a paper, read by M. A. Lavezzari, before the Paris Society of Civil Engineers, the author gave many particulars of the system of gas traction on street railways, which, having its inception at Dresden, is now being tried at Dessau, Blackpool and Paris. The motor employed is of the Otto type, having two cylinders, and is located under the seat, one side of the car. Access for cleaning, etc., is obtained through suitable doors. For ignition electricity is used, it being thought undesirable to keep uncovered lights burning close to the inflammable material of which the car is built. To change speed or direction, gearing is employed, two different speeds being available at will. The speed lever and reversing lever are both fitted on the car platform. When the former is in mid position the engine runs free, though, as at the same time its gas supply is throttled, its speed falls to 80 revolutions per minute. Pushing the lever to right or left places either the high or low speed in gear with the engine, simultaneously fully opening the gas valve and causing the engine to run at its normal speed of 220 revolutions per minute. The gas is carried in three reservoirs, two of which are fixed under the opposite seat to that concealing the motor. These reservoirs have a capacity of about 35 cubic feet, and are charged initially to a pressure of 140 pounds to 170 pounds per square inch. The cooling water is carried in tubes placed in the roof of the car. At the compression stations a small gas engine is used to drive the pumps which charge reservoirs connected to a standpipe near the track. When a car requires recharging, its tanks are connected to this standpipe and the valve opened, when about two minutes is sufficient time to completely recharge the car. At Dresden the line is about 2.2 miles long, and includes one grade of 4 per cent. The cars are small, and consume about 36 cubic feet of gas at ordinary pressure per car-mile, including that used at the compression-stations. At Dessau the line was opened at the end of 1894, and is nearly 4 miles long. It comprises one 5 per cent. grade about 200 feet long, and a curve of 50 feet radius.

Their are 13 cars on service, four of which are supplied with 10 to 12-horse power motors, and nine with those of 7 to 10-horse power. The motor cars weigh 6 tons empty and 8 tons loaded, and there are, moreover, 7-ton cars. The gas is stored at a pressure of 142 pounds per square inch in tanks of 28.25 feet capacity. With this supply a run of 10 to 12 miles can be made without recharging. The cooling water carried is only about 18 gallons. The speed is limited to a maximum of 7½ miles per hour. The consumption of gas is 30 cubic feet per car-mile, 10 per cent. of which is used at the compression stations. At Paris the experimental car tried weighed 7 tons empty, and 10 tons when loaded with 42 passengers. The motor of 10 to 15 horse power was designed to run at 100 revolutions when the car was stationary, and at 250 when the latter was moving. The tanks were of 44 cubic feet capacity, and were charged to a pressure of 142 pounds per square inch. The water carried was 19 gallons. The speed attained reached 10 miles per hour, the gas consumption, exclusive of that used in compression, being 31 cubic feet per car-mile, and about 14 miles could be run without recharging.

The Winn Adjustable Screwing Stock.

The illustrations show a form of stock and dies, which apparatus is finding favor on the English market, the manufacturers being the Messrs. Charles Winn & Co., of the St. Thomas Works, Granville street, Birmingham. With the device a number of different sizes of tubing, etc., can be threaded without changing the dies. These latter,



The Winn Adjustable Screwing Stock.

of the chaser type, are four in number, and can be moved in towards or out from the center of the stocks by turning round the upper cap plate, in which are formed spiral threads engaging with grooves cut in the dies. An index shows the size of tube for which the instrument is adjusted at any time. Guides operated in a similar way by the lower cap plate serve to center the tube whilst being screwed. A full thread is cut at one operation, the pitch being, of course, the same for all sizes of pipe cut. The handles are hollow and can be removed for transport.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, March 10th, 1897.

Gas Stoves on Hire.—A New Sin.—The Denayrouze Burner.—Water Gas at Liverpool.

The supplying of gas stoves on hire appears to find more favor in England than in America. I notice that whenever a discussion is held on this subject in the United States, several speakers express dissatisfaction, and say they are discouraging and actually discontinuing the practice; whereas in England there is no parallel expression of such opinion. Letting on hire is practiced with but few exceptions by every gas company in England, and I never heard of any instance where, once having been started, it has been discontinued.

There is such a demand for stoves from people who will not buy them on any terms, that sometimes the supply is checked for financial reasons, either because the whole available capital is expended and the directors do not care to raise more, or because it is considered that the amount invested in apparatus for hire should not exceed a certain proportion of the total turnover. Standing on its own bottom, letting on hire is not a profitable business, that any private individual or company would care to take up and work as a separate venture, but the usual experience is that it can be made to pay its own footing.

A few notes on the history of this investment in England may be interesting. From the earliest days of gas lighting there were some companies who dealt with appliances in various ways, some even manufacturing their own stoves and meters, and Acts of Parliament always include a clause empowering them to let appliances on hire. But in many cases this power was not used at all, and down to about 40 years ago, the companies who hired out stoves were the exception and not the rule. About 1860, when the increased demand for gas rendered it possible to sell gas iu our principal towns for something like 4s. per 1,000 cubic feet, some of the more enterprising undertakings began to let stoves on hire. But it was not till the year 1884 that the movement became general. In 1883, under the auspices of the Gas Institute, a fund of £6,000 was raised by gas companies for the purpose of holding a substantial exhibition of gas appliances at the Crystal Palace, near London. A part of this fund was expended in exhaustive tests both of cooking and heating stoves. These tests were the most useful part of the whole proceedings, as they exposed the weak points of the apparatus then on the market. Double-cased stoves were at that time a novelty, and most of those in use were either plain sheet or cast iron.

After the publication of the tests, manufacturers rose to the occasion, and the leading makers rapidly adopted the principal features necessary both for economy and efficiency and began to study the hiring trade. The tests also had the effect of leading many gas managers to make independent investigations. Several important improvements, chief amongst which may be instanced the use of enameled steel, were introduced, and letting on hire became an established rule. Soon after this another important fact became apparent. Not only did the hirers expect to have the newest and best improvements, but, notwithstanding the increased first cost, the best proved to be the cheapest for letting on hire. People who cared nothing for the sheet iron box with two or three boiling burners on the top, appreciated the enterprise of the gas company in providing a double cased stove with enameled steel interior, griller, etc., and took an interest and a pride in keeping the appliance clean and in order. It is the general experience in England, not only that there are less complaints, but that the repairs and renewals run very much less for the new, as compared with the old-fashioned stoves. So the usual practice is to supply the best make of stove. If, in districts occupied by the poorer classes of the community, a cheap stove is asked for, those made of cast iron are preferred to the sheet iron box.

It is all very pretty to preach about the convenience, cleanliness, efficiency, etc., of gas as compared with coal. A certain amount of business may be obtained by such arguments, but the adoption of gas stoves would not be so large or assume such important proportions as compared with the entire make of gas, if the question of economy had not been considered, and if their efficiency ha l not been so far advanced as to render them capable of competing in point of cost for fuel with coal. It was in this direction that the Crystal Palace tests proved of so much advantage, and the published reports may be recommended to the attention of all who are interested in the introduction of gas for cooking or heating.

Amongst the numerous ingenious methods of pushing the use of gas stoves is one which I have not yet seen mentioned in print, but which has been used with very satisfactory results. It is simply a four page leaflet, suitable for enclosing in envelopes, with bills, etc., with a striking headline, "What the residents of (here insert the locality) think of gas stoves," followed by short letters from prominent residents who are in the habit of using such appliances. A testimonial from the mayor, an alderman, minister of religion, or other well known public personage, expressing satisfaction as to the efficiency and economy of the gas stove, carries greater weight than the arguments of the canvasser, or the pleasingly expressed advice of the lady demonstrator. The use of the word "lady" reminds one of the importance, as I see some of our friends have discovered, of getting at "the lady of the house." When young and inexperienced I remember taking a great deal of trouble to persuade members of my own sex as to the advantage of using gas stoves. I don't waste time on that line now. Once secure the ear of the lady of the house and it doesn't matter a bit what the "gentleman" thinks about it.

Gas companies are so frequently blamed for things they have done and things they have not done, that it scarcely seems possible to find a new charge against them. Something very much like one has, however, lately gone the round of the papers. In a certain district, after some disputing about the price, it was announced that a reduction would be made, from on and after the 1st January, 1897. It is alleged that "on this occasion only," the meter takers were several days late. Consequently the bills for December quarter were not only larger than usual, but included an indefinite quantity of gas priced out at the old rate, which should have been charged at the new one. What a grand opportunity for the consumer who reads his own meter.

An important improvement in connection with incandescent gas lighting is about to be placed on the market, and it is claimed to have the effect of still further enhancing the already high duty obtainable by means of this system, and at the same time dispensing with glass chimneys. The only object of a glass shade will be for the protection of the fragile mantle in windy or exposed places, as it is claimed that the new form of burner admits of the mantle being left as free as an ordinary flat flame burner. It is now some time since M. Denayrouze, who has been called "the father of electric lighting in Paris," showed that by intimately mixing the gas and air previously to combustion, the duty

could be more than doubled. In the first form of burner exhibited the mixture was effected by means of a small electric motor. But after a considerable amount of research and experiment, M. Denayrouze has designed a form of burner that practically secures the same advantages without the use of machinery. An exhibition of the burners has lately been made at a place of public entertainment in London, and the newcomer is a decided advance in the direction of large light centers, as any number of burners can be contained under one shade or in one lantern. These burners are already in use in Paris, and a syndicate has been formed for the purpose of introducing them in England, where they will assist in increasing the popularity and the demand for incandescent gas lighting. It is interesting to note that M. Denayrouze claims that his burner is an improvement on electric lighting, and will produce superior effects. Remembering how much has been written and said about the superiority of electric lighting as compared with gas, this looks like turning the tables.

Since writing last month a report on water gas has been published at Liverpool. It is an official document prepared by the Gas Examiner, Mr. Bellamy, with the assistance of Prof. Campbell Brown, of the University College, and contains a great deal of useful information evidently collected with great care, and with every endeavor to get at the real facts of the matter.

It supplies just what was wanting in the complaints to which I alluded last month, and follows the lines then indicated of dealing with actual analyses of the gas supply. The conclusions arrived at are not exactly what the authors of the panic which led to the inquiry would wish them to be, and Mr. Bellamy is to be commended for his fairness and independence in stating the case without prejudice, fear or favor. He remarks that, whereas in other towns of England where water gas has been adopted, it is always mixed with coal gas, in Liverpool it is delivered into the mains in an unmixed state, and consequently the districts in the neighborhood of the particular station where the water gas is made, are supplied with the unmixed gas. The new gas is heavier and requires larger burners than coal gas, and with the burners unaltered the effect of changing from one gas to the other is a decreased consumption, and consequently less light, which difficulty is accentuated in the course of time by accumulations of carbon at the outlet of the burners. Full particulars of the cases which originated the question are given. They are only four in number, and two were fatal.

From the analyses made by Prof. Campbell Brown it appears that Liverpool coal gas contains 7 per cent. of carbonic oxide, and that a sample of gas taken from a district where the mixed gases were supplied contained 19 per cent. of carbonic oxide. While this was certainly likely to increase the liability to accident by poisoning, the author shows that there is practically no risk so long as the gas fittings are in proper order. Quoting from Dr. Haldane, there was no immediate danger, if the proportion of carbonic oxide in the air did not exceed 0.1 per cent. In a small room an ordinary burner must be full on for more than an hour, and a flash light or burner turned to a glimmer must be on for eight hours or more before this proportion was reached, assuming there was no change of air from ventilation. Some very useful hints are given on the question of leakage, the management of water slide gasaliers, etc. Of 23 cases selected in different parts of the town, not one would have passed the tests usually applied in America. The leakage ranged from ¼ to 2¼ cubic feet per hour, from which it is evident that systems of fittings should be periodically tested, which could be done at any time by the consumer himself with the aid of the test dial on the ordinary meter. Referring to the Registrar General's returns, there was certainly some increase in the mortality from accidents with gas. This was only 7 in 1890, against 14 in 1894.

But the same period that had seen the introduction of water gas had also witnessed a large increase in the number of gas consumers, chiefly on the prepayment meter system. The figures are a striking proof of the comparative safety of coal gas, as in 1894 there were no less than 143 fatal accidents with oil lamps. There was no doubt as to the right of the company to make and supply carbureted water gas, and that it was financially and otherwise an advantage to them, but the consumer had not participated in this to any extent. From inquiries addressed to eight towns where water gas was used, it appears that it is mixed with coal gas in proportions ranging up to 50 per cent. No difficulty on the score of combustion has arisen or had the introduction of the water gas led to complaints from the consumers. In some cases the economy thus secured had enabled reductions in price to be made. Altogether Mr. Bellamy's investigations appear to be in favor of water gas rather than otherwise, not only from the gas companies' but from the consumers' point of view.

Tests of Non-Metallic Water Pipes.

Mr. W. H. Landis remarks, in *Municipal Engineering*, that Dr. B. Gosio, official health physician, has undertaken, under the direction of Professor Pagliani, of the scientific laboratory of the department of public health of Rome, to determine the resistance to bursting, permeability, absorption, etc., of water pipes made of terra cotta or baked clay, stone and cement, the materials most used in Italy. The object of these tests was to ascertain to what extent the liquids injurious to health would pass into or out of such pipes while in service, and thus determine their relative availability for various sanitary uses.

Resistance to internal pressure rarely exceeds 7 atmospheres. Terra cotta pipes, 2 to 4 inches internal diameter, will withstand an internal pressure of 20 atmospheres, or about 300 pounds to the square inch. Stone has the least resistance, giving way under a pressure of 60 pounds to the square inch. Small pipes of cement 21 inches long, 1.36 inches inside diameter and 1.56 inches in thickness, withstood a pressure of 7 atmospheres, although cracks which, however, caused no leaks, began to develop at 5 atmospheres pressure, especially when the stress was sustained. He states that for other sizes the resistance varies, without exception, inversely to the internal diameter. A terra cotta pipe 2½ inches internal diameter will sustain 20 atmospheres, while one 4½ inches diameter will bear but 6 atmospheres when of the same thickness. It is unfortunate that the experiments were not continued to show the ratio of this variation.

The author distinguishes between permeability and absorption; cement absorbs 9.5 per cent.; terra cotta, 7.80 per cent.; stone, 4.16 per cent.; nevertheless, in practice terra cotta is more permeable than cement. Absorption is measured by the ability to contain water for a long time after being saturated with it and exposed to the sun. Permeability is indicated by a small prolonged pressure, say of 2 atmospheres for 8 days, and is measured by the quantity of liquid passing through the material. Terra cotta gives the greatest permeability, cement next, while stone is least permeable.

Experiments were also made to determine the quantity of water that would filter from the external soil into the pipes by hermetically sealing the small end of the pipe and placing it vertically in water and measuring the depth of water that would leak into it. At the end of 72 hours a glass rod covered with paper was dipped into the pipe and the depth of water observed on the wetted paper. Terra cotta let pass the most water. The other pipes let nothing pass until the air was exhausted, then it was found that cement still held its place between terra cotta and stone. He also insists on perfect joints and prefers a silicate of soda glaze, as lead glaze is liable to be attacked by the acids in waters from domestic uses.

Tests of Riveted Joints.

Engineering Record remarks that the strength of riveted joints is a thing which is usually calculated, and the maximum strain which a boiler shell will stand is based upon the result of such calculation, according as the joint is of one form or another. Nothing of the kind is so conclusive, however, as actual test of the joint and a determination of the ultimate breaking strain. The results of some recent tests at the Watertown Arsenal, made for Edward Kendall & Sons, are therefore of interest.

The tests were all made on steel plate nominally ½-inch thick, and all the rivets used were ⅞ inch diameter, with 1 1/16-inch drilled holes. The ordinary double-riveted joint 13.5 inches wide, with rivets pitched 3⅛ inches apart, broke when the strain was 47 per cent. of the tensile strength of the solid plate. A butt joint with double covering plates, one 10⅜ inches wide and one 5½ inches wide, with the two rows of through rivets pitched 3⅛ inches, and the outer rows twice this distance, gave an efficiency of 57 per cent. This joint was 27 inches wide. A similar butt joint with the lower covering plate 15½ inches wide, and containing four rows of rivets, the two rows of through rivets being spaced 2½ inches apart, showed an efficiency of 78 per cent., the plate containing the joint in this case being 20 inches wide. The lengthening of the covering plates and introduction of two more rows of through rivets increased the efficiency only 0.6 per cent.

In another series of tests made with the ordinary form of triple-riveted butt joints, having one covering plate 10 inches wide and one 15.5 inches wide, the joint broke with a strain of 80 per cent. of the strength of the solid plate when the rivets were pitched 3⅛ inches, and with a strain of 83 per cent. when the pitch was 2½ inches. When the lower strap was lengthened to 22 inches to receive two extra rows of rivets, and the joint was tested at a temperature of 410° F., the efficiency

was 90 per cent on one trial and 85 per cent. on another. The rivets were pitched in these cases 2½ inches. When the same arrangement was tried with a pitch of 3½ inches, the efficiency dropped to 82.5 per cent.

These trials show that the finer pitch secures the stronger joint, and that, in either case, the triple-riveted butt joint, having double covering plates, can be made to give an efficiency of 80 to 85 per cent.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. THOMAS BOURNE, Superintendent of the Clarksville (Tenn.) Gas Light Company, died about a fortnight ago.

THE regular quarterly dividend of 2 per cent. on the shares of the Worcester (Mass.) Gas Light Company is payable on Thursday.

AT the annual meeting of the Middletown (Conn.) Gas Light Company the officers chosen were: Directors, A. B. Calef, W. T. Elmer, W. H. Barrows, H. Woodward and H. L. Mansfield; President, A. B. Calef; Secretary and Treasurer, H. L. Mansfield; Superintendent, Seth Clark.

THE assignee of the Winnepesaukee Gas and Electric Light Company, of Laconia, N. H., acting under the instruction of the court, recently offered the Company's properties at public auction. The purchaser was Mr. Aldrich, President of the Lakeport National Bank, whose bid price was $500. The purchaser obtains the property subject to a bonded indebtedness of $40,000, and two attachments amounting to $3,600.

A CORRESPONDENT, writing from St. Louis, Mo., under date of the 19th inst., says: "The Missouri Water, Gas and Electric Light Association held its third annual convention in Sedalia, Mo., commencing March 16th. Mr. J. A. Montgomery, of Sedalia, presided, and Mr. C. F. Strohm, of Nevada, acted as Secretary. A resolution favoring uniform rules (to apply to all districts of the State) for wiring and house piping, the rules to be enforced or directed by inspectors to be appointed by the local authorities, was adopted. Under the resolution Messrs. Montgomery, Quigly, White, Wirt and Strohm were appointed a committee on rules and regulations for the direction of wire fitters, plumbers and architects, the rules to conform as near as possible to those of the United States Board of Underwriters. In a vigorous discussion, the sentiment of the delegates was largely in favor of the passage by the Legislature of a bill establishing a State commission clothed with power to regulate water, gas and electric lighting rates in the State; to establish a standard of purity and a rate of candle power for gas supplied; to fix a standard of measuring the illuminating power of electric lights, and to maintain the purity of watersheds, of water supplied, and so on—quite a contract for any commission. The former officers were named to manage the affairs of the Association until the next meeting, which will be held in Sedalia the second Tuesday in September."

THE Dickson Manufacturing Company, of Scranton, Pa., has commenced the construction of a new boiler shop, to be 130 feet in width and 225 feet in length. The framework of the building will be of steel throughout, the sides are to be covered with corrugated iron, and the roof is to be of composition roofing material, on plank. The main boiler shop is about 52 feet wide and 45 feet high. Thirty feet above ground is a runway, of substantial steel girders, arranged to carry a 30-ton travelling crane. At one end of the main shop is a riveting tower 25 feet by 50 feet, having a runway carrying a 20-ton crane, at a height of 50 feet above the floor level—the crane in the riveting tower runs at right angles to the one in the main shop below. Adjoining the main shop is a punch room, which is about 50 feet wide, and extends the full length of the building. Attached to the roof trusses of this portion is a travelling crane of 5 tons capacity, which covers the whole floor surface. Adjoining the punch shop is a space, 25 feet wide and 225 feet long, for the flange fires and other furnaces. All the main posts of the building are arranged so that jib cranes can be attached to them, and the trusses are disposed so that shafting and other machinery may be attached at convenient points. This structure when completed will be as well equipped for its purposes as any other shop in the country. The steel work was designed and will be furnished and erected by the Berlin Iron Bridge Company, of East Berlin, Conn.

MR. W. ELIOT FETTE, Managing Director of the Dedham and Hyde Park (Mass.) Gas Company, writing from Boston under date of the 17th inst., says:

To the Editors AMERICAN GAS LIGHT JOURNAL: In justice to my friend, Mr. Thomas Curley, of Wilmington, Delaware, I feel that I ought to say that the idea of the water heater for the gasholder tank[1] of the Dedham and Hyde Park Gas Company came first from him. Mr. Curley has for many years kept the water warm in a tank at his works, through the winter, by means of a water heater of his own design, which he has shown me in operation on more than one occasion. The use by us of an ordinary heater, such as is employed in houses, was merely a modification by Mr. Todd of Mr. Curley's idea. I have always wondered that the latter had not been adopted by every company having an open holder at a distance from the works.

THE regular dividend of $1 per share on the stock of the Providence (R. I.) Gas Company is payable next Thursday.

THE following is the full text of the measure, reported by the Committee on Miscellaneous Corporations of the New York Senate, as a substitute for the Cantor-Laimbeer bill, which sought to fix the gas rate in New York at $1 per 1,000 cubic feet during the current year—the main points in the substitute bill were given in our financial column for last week:

"Section 1.—A corporation, association, company, copartnership or person shall not charge or receive for illuminating gas, in a city as now constituted, which has a population of 1,500,000, sums to exceed per 1,000 cubic feet, during the remainder of the year 1897, $1.20; during the year 1898, $1.15; during the year 1899, $1.10; during the year 1900, $1.05; and during each year thereafter, $1.

"Sec. 2.—Such a corporation, association, company, copartnership or person shall not charge for illuminating gas for the use of any city sums to exceed, per 1,000 cubic feet, during the remainder of the year 1897, $1; during the year 1898, 97½ cents during the year 1899, 95 cents; during the year 1900, 92½ cents; during each year thereafter, 90 cents.

"Sec. 3.—A change hereafter effected in the territory or boundaries of such a city, either by annexation, consolidation or otherwise, shall not be deemed to enlarge or change the territory within which the price of gas is regulated as herein provided, but this act shall continue in force for the purpose of regulating the price of gas in such city as now constituted, notwithstanding any subsequent change of territory, but shall not apply in or to territory not now in such city.

"Sec. 4.—The illuminating gas furnished by any such corporation, association, company, copartnership or person shall have an illuminating power of not less than 22 sperm candles of 6 to the pound, burning at the rate of 120 grains of spermaceti per hour, at a distance of not less than one mile from the place of manufacture, by a burner consuming 5 cubic feet of gas per hour, and shall, as regards purity, comply with the standard now or hereafter established by law.

"Sec. 5.—All acts and parts of acts inconsistent with this act are hereby repealed.

"Sec. 6.—This act shall take effect on the 1st day of May, 1897."

THE formalities connected with the changes in the corporate title and ownership of the Jackson (Mich.) National Gas and Fuel Company were completed some days ago. The title of the Company is now the Jackson Gas Company, and its officers are: Directors, H. D. Walbridge, Emerson McMillin, N. S. Potter, T. A. Wilson, Wiley R. Reynolds, Stephen H. Carroll and Albert Stiles; President, E. McMillin; First Vice-President, H. D. Walbridge; Second Vice President, N. S. Potter; Secretary-Treasurer, W. F. Douthirt; General Manager, W. M. Eaton.

MR. A. C. DEVERELL, on the occasion of his resigning the position of Assistant Secretary-Treasurer to the Seattle (Wash.) Gas and Electric Light Company (he goes to engage in business in St. Paul, Minn.), was presented by his fellow employees with a handsome umbrella, the stick of which is topped with gold.

A CORRESPONDENT, writing from Phœnix, Ariz., under date of March 15th, says: "The authorities of Phœnix have granted an ordinance to the projectors of the Phœnix Light and Fuel Company. The Company may not charge in excess of $4 per 1,000 cubic feet, but the likelihood is that the initial price will be put at $2.50. The works are to be completed and gas is to be supplied within a year from the granting of the franchise. The scheme of manufacture proposed is of the fuel gas order, the gas to be consumed through burners of the Fahnehjelm type. Mr. J. T. Pickerell is Superintendent of the Company."

THE reorganization of the gas interests of Chicopee, Mass., has been

1. See JOURNAL, March 1, p. 330.

completed. The name of the succeeding corporation is the Chicopee Gas Light Company, which is capitalized in $75,000 stock, the bonded indebtedness being $60,000. The officers are: President, H. A. Odell; Treasurer, M. J. Luther; Clerk, Luther White; Superintendent, C. H. Nutting. The Company has arranged to lay 10 miles of mains, and will thoroughly overhaul its water and coal gas plants. The main laying and reconstruction will be carried on under the supervision of Mr. Walter P. Elliott.

AT the meeting of the Board of Directors of the Nashville (Tenn.) Gas Light Company, held for perfecting the executive organization of the Company, the following officers were chosen: President, V. L. Kirkman; First Vice-President, Henry Morgan Brown; Second Vice-President, James Simmons; Secretary and Treasurer, H. L. Sperry; Superintendent of Manufacture and Distribution, J. Frank Stacey. Mr. V. L. Kirkman was elected President in place of General W. H. Jackson, who, we regret to have to say, sails for Europe shortly because of ill health. The General, however, retains his place on the Board of Directors.

ON March 20th application was made to Attorney-General Hancock, of New York, asking him to bring an action to annul the charters of the Newtown Gas Company and the Newtown Light and Power Company, of Newtown, L. I. The Companies were served with notice that the application would be pressed before the Attorney-General last Tuesday. Mr. R. W. Keene, Attorney for the applicants, says that these Companies have not filed annual statements of their condition with the Secretary of State, as required by law, and that they have secured lighting contracts in Newtown for the purpose of sub-letting them.

THE first annual meeting of the Tampa (Fla.) Gas Company was held about a fortnight ago. The reports for the year showed that the estimate of the founders of the Company, that there was a place in Tampa for such an enterprise, was well founded. The officers chosen were: Directors, Edward Manrara, A. J. Boardman and P. O. Knight; President, Edward Manrara; Vice-President and General Manager, A. J. Boardman; Treasurer and Attorney, P. O. Knight.

THE Capital City Gas Company, of Des Moines, Ia., is offering an excellent security, in the shape of an issue of $235,000 first mortgage (gold 6's) bonds.

THE Committee on Incorporations, Connecticut Legislature, has reported against the petition of the projectors of the Conemo Fuel and Illuminating Gas Company, who proposed to manufacture and supply gas in the towns of Danbury and Bethel.

AT the annual town meeting, Revere, Mass., the matter of establishing a gas works there, to be operated on municipal account, was referred to a special committee of five.

A COMPANY to supply gas in Humboldt, Kansas, has been incorporated by Messrs. T. E. Dole, W. F. Fussman, C. H. Pratt, J. H. Gants and Geo. Nayes.

WE regret to report the serious illness of Mr. Adolph Vogel, for many years Treasurer of the Cambridge (Mass.) Gas Light Company. He was stricken with paralysis on the afternoon of the 18th inst.

THE Portland (Ore.) Gas Company has removed its offices to spacious quarters in the Goodenough building, directly opposite the post office. The showroom is a model of tasteful arrangement, and its floors are well covered with many specimens of the latest things in gas cookers, heaters, etc. The Welsbach lamp exhibit is also complete and attractive.

THE ninth annual meeting of the managers and superintendents of the United Gas Improvement Company, was successfully brought off in Philadelphia and Reading, Pa., beginning in Philadelphia on the 17th and ending in Reading on the 20th. The proceedings in Philadelphia were held in the Hotel Walton, and on the 18th, 19th and 20th, the meeting was continued and terminated in Reading. Mr. John H. Keppelman, of Reading, was the host, and a right good one he was. About 50 delegates were in attendance, and the proceedings, from a technical point of view, were interesting and valuable. The social side of affairs was not neglected, perhaps the most enjoyable item in that connection having been the banquet at the Mansion House, Reading, on the 20th. Mr. Walton Clark acted as toastmaster, and the guest of the evening was the Mayor of Reading, Mr. Weidel. Speeches were made by Mayor Weidel, Mr. John H. Keppelman, Mr. A. B. Beadle, Mr. J. M. Knapp, Mr. L. M. Searle, Mr. L. L. Kellogg and Mr. C. H. Page.

MR. CHARLES W. BROWN, Manager of the Ipswich (Mass.) Gas Company, has made a proposition to the Selectmen of the town to light the main streets, in the center of the thickly built-up district, with Welsbach lamps. He estimates that 70 lamps will be required, and agrees to furnish that number for the annual total payment of $1,755, a moontable to be followed. This figure includes renewals to mantles and all ordinary repairs.

A CORRESPONDENT says that a new ordinance providing for a gas inspection bureau and a gas inspector has been introduced in the City Council of Kansas City, Mo. It specifies the nature of the tests to be made, both in the instance of the lighting value and purity of the gas supplied, and the accuracy of the meters through which the gas is passed, and fixes a maximum salary for the Inspector of $125 per month. All of the expenses of the bureau, including the cost of purchasing and setting up the testing apparatus, are to be borne by the local gas companies. The inspector is to be appointed by the Mayor subject to confirmation by the Council.

THE consolidation of the Kansas City (Mo.) Companies will be completed shortly. It is likely that the name of the succeeding corporation will be the Kansas City-Missouri Gas Company.

THE hearing before the Board of Gas and Electric Light Commissioners, which body has been charged by the Massachusetts Legislature with the investigation of the gas explosion at Tremont and Boylston streets, Boston, will be most thorough.

THE reduced gas rates (to $1.75 per 1,000 cubic feet for an illuminating supply, and to $1.60 for fuel use) ordered by the Oakland (Cal.) Gas Light and Heat Company, have been favorably received by the newspapers and the people of that city. The original gas rate in Oakland was $7.50 per 1,000.

THE demand for prepayment meters is becoming more positive every day, nor is it confined to the more populous centers. In New York and Brooklyn the meters are being placed in great numbers.

Carbons for Electrolysis.

Engineering Magazine, in noting that the extension of electrolytic processes in industrial chemistry has created a demand for terminals which shall be inexpensive and permanent, numerous patents in this line having been taken out, especially in connection with the electrolytic production of the alkaline chlorides, says that Dr. Albert Lessing describes, in the *Elektrochemische Zeitschrift*, some of the objections to those in use, and claims to have overcome the difficulties. The ideal anode should possess the qualities of permanence, small volume and moderate expense. The first two properties are possessed by platinum, but its high cost is prohibitive for use in large operations, such as commercial reasons demand. Carbon has been used as the most available material, but in its present forms is not free from objection.

Gas carbon is not available in large sheets, such as are commercially required, and hence these have been made of powdered coke, baked with a cementing material in the same manner as electric light carbons are made. Such carbon plates, however, are not permanent, but soon become disintegrated by the action of the solutions, and especially by the action of the liberated gases.

This disintegration is rather a mechanical than a chemical action, and the slightest porosity or the finest crack gives the gases a chance to enter, after which the carbon flakes off in layers and crumbles away, fouling the bath and interfering with the work.

Dr. Lessing claims now to have solved the problem, after much experimenting, by producing carbon sheets entirely homogeneous and free from cracks, by a fusing process which not only insures the permanence of the sheet, but also increases its conductivity.

The new product is said to be harder than steel, readily scratching glass, and proof against the emery wheel, and possesses a metallic ring which testifies to its homogeneity.

If these claims are maintained, and the prepared carbon can be produced at a reasonable price, it should soon be on the market for many other uses as well as the one for which it was originally produced.

THE AMERICAN GAS LIGHT JOURNAL

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MONDAY, MARCH 29, 1897.

Fuel Quantities for Stationary Boilers.

Cassier's Magazine for March says that the proper quantity of coal to burn under stationary boilers in order to secure the best possible economic results has more recently again been under investigation. The results have been given in a paper presented at the annual meeting of the American Society of Mechanical Engineers a short time ago by Mr. Wm. Wallace Christie, and are based upon the data of 108 different boiler tests, obtained from various sources, and reasonably authentic, so that the averages may be taken to fairly represent present practice. The substance of Mr. Christie's work was given in the shape of a set of curves, plotted from the figures gathered, and which showed that 13 pounds of anthracite coal burned per square foot of grate per hour gave the greatest economy in evaporation. The greatest amount of anthracite coal found to have been burned per square foot of grate per hour was 33.70 pounds; the least 4.70 pounds.

The greatest amount of bituminous coal found to have been burned per square foot of grate per hour was 57 pounds; the least, 6.70 pounds. Land stationary boilers were the only ones considered. Less than 4 pounds of coal, it was found, in the greater number of cases, had to be burned per square foot of grate per hour to produce a horse power, and as 13 pounds of coal were found the most economical rate of combustion, 13 divided by 4, or 3.25 horse power per square foot of grate per hour are economically attainable. In the case of bituminous coal 23.8 pounds burned per square foot of grate proved an economical rate of combustion, and 23.8 divided by 4, or 5.95 horse power per square foot of grate per hour, are, therefore, economically attainable. The averages of the whole number of tests were—3.64 pounds of coal per horse power developed per hour; 3.04 pounds of combustible per horse power per hour; and 18.16 pounds of coal per square foot of grate per hour. These figures are for both anthracite and bituminous coal.

The Market for Gas Securities.

Curiously uneven conditions prevailed in the market for city gas shares last week, but on the whole, prices were fairly well maintained. One cause for the perturbation of investors was the weakness of the general share market, consequent on a fuller realization of the meaning of the decision recently handed down by the United States Supreme Court in the matter of railroad associations for the simplification of passenger and freight tariffs, and so on. A second cause was in the situation in Albany over legislation respecting, prospective though that legislation be, gas rates. The Albany situation is muddled, and the muddle rests quite wholly with the legislators themselves, who are in no wise anxious to duplicate the action of their predecessors of some years ago, when the latter cut the gas rate from $1.75 to $1.25 per 1,000.

However, the signs current over gas legislation all point to the fact that whatever is done in Albany thereon will not be radically harmful to the gas interests; that if any change is made the plan of it will be on a sliding scale, with a reasonable decrease per 1,000 over a term of years. The Brooklyn Union Gas Company has determined to act on the contract accepted by the Board of Aldermen, although the Mayor refused to sign it, and its counsel have assured it that the measure is as binding on the city and on its citizens as it is on the Company itself. Other comment on this matter will be found in our editorial pages.

Consolidated sold down to 156¼ during the week, and the opening to-day (Friday) was made at 157¼ to 158. The stock is, in our opinion, very cheap at these figures; for the local conditions, so far as the restoration of harmony is concerned, are all that could be desired, and the output of the several Companies is very satisfactory. New York and East River common advanced to 54½—in fact, some had it that sales were made at 55—but the close of the week finds it at the quotations of the week before—52½ to 53½. The preferred is also steady. It is not at all unlikely that a dividend on the preferred will soon be in order. Mutual is exceptionally strong; 239 is bid for it, but we doubt that an offer of 250 would bring out much of the stock. Equitable shows no change. Standard securities are higher.

Brooklyn Union is a trifle easier, at 97¼ to 98½, which looks 10 points at least below its real value. The bonds are 110 bid. The wonderfully strong position of this Company does not seem to be very generally understood.

Chicago gas sold well above 80 during the week, but weakened with the general market, the opening to-day having been made at 78¼ to 78½. A fair price for this stock just now would be 85. The Ogden opposition can be overcome at any time, and the Universal Company's huge plant need not be regarded as a menace.

Bay State is dull and neglected, and Consolidated, of Baltimore, is also in the doldrums. There is no good reason, however, for the apparent weakness shown by it. Laclede bonds are active, at better prices than have ruled in them for some time.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

MARCH 29.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,480,000	100	157½	158
Central	500,000	50	195	..
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	206	209
Bonds, 6's	1,000,000	1,000	105	.
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	239	242
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150,000	50	85	
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	53½	53¾
Preferred	2,000,000	100	89	90
Bonds 1st 5's	3,500,000	1,000	106	107
" 1st Con. 5's	1,500,000	..	97½	98½
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	
Standard	5,000,000	100	86	87
Preferred	5,000,000	100	110	..
Bonds, 1st Mortgage, 5's	1,500,000	1,000	110	..
Yonkers	299,650	50	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	97½	98
" " Bonds (5's)	15 000,000	1,000	110	..
Bay State	15,000,000	50	10	10¼
" Income Bonds	2,000,000	1,000	..	85
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	..	85
2d " " "	3,000,000	1,000	70	72
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	78¼	78½
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	94	94¼
Columbus	1,000,000	..	68	70
1st Mortgage	1,085,000	..	..	96
Consumers, Jersey City	2,000,000	100	..	75
" Bonds	600,000	1,000	100	102
Cincinnati G. & C. Co.	8,500,000	100	201½	202½
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	1,000,000	100	60½	61¼
Mortgage, 6's	3,500,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000	..	22	..
" Con. Bonds	4,312,000	..	73½	74
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	82	84
" Bonds	2,000,000	..	91	93
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	130	135
" Bonds, 6's	2,650,000	..	105	107
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	84	88
Bonds	1,000,000	1,000	92	94
Louisville	2,570,000	50	..	..
Laclede, St. Louis	7,500,000	100	23½	23¾
Preferred	2,500,000	100	70	73½
Bonds	9,084,400	1,000	95½	95½
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	98	98
Bonds, 6's	4,000,000	.	123	..
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	53½	54
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Paterson, N. J.	.....	25	99	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	97¾	98¼
St. Paul Gas Light Co.	1,500,000	100	67½	70
1st Mortgage, 6's	650,000	..	84	87
Extension, 6's	600,000	..	.	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	500,000	25	..	..
Washington, D. C.	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	50	61
Bonds, 5's	3,556,000	.	90	91
Wilmington, Del.	800,000	50	180	182

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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
DREXEL BUILDING, PHILA., March 25, 1897.

The Directors have this day declared a quarterly dividend of 2 per cent. ($1 per share), payable on April 15, 1897, to stockholders of record at the close of business March 31 Checks will be mailed.

1138-2 EDWARD C. LEE, Treas.

POSITION WANTED

By a Good Gasfitter.

One used to work of Gas Company. Good reference from New York Company. Address

1137-3 "M.," care this Journal

Position Desired

As Superintendent of Gas Works or Gas and Electric Light Works,

By a man 34 years of age. Sixteen years' experience in the manufacture and distribution of Coal Gas as Supt., and four years in the Electric line. Thoroughly competent to take charge of any plant, separately or combined. A practical mechanic, and understands the erection of gas plants and everything pertaining to the business. Not afraid of work. Salary no object until ability is proven. Best of references.

1102-tf Address "M. E. J.," care this Journal.

WANTED,

A Second-Hand Gas Generator,

Capacity about 25,000 cubic feet per day; must be in good condition. Address, stating lowest price,

1132-1t "J. B.," care this Journal.

WANTED,

Two Purifying Boxes, about 8 ft. x 10 ft. x 4 ft., with Overhead Traveling Carriage and Hoist.

One Gas Exhauster, with Engine on same Bed Plate, Governor and Bye Pass complete, ready for running. Capacity about 6,000 per hour.

One Station Meter, capacity 6,800 per hour, with overflow. All connections 8-inch. Give price, name of maker, present condition, history, past use, whether in use and detailed specifications.

Address C. W. McCORKLE,

1133-2t 809 Union Trust Building, Detroit, Mich.

WANTED,

Position to take full charge of works, or Superintendent of Manufacturing and Distribution. Seven years' experience in pushing the stove business. At present in charge of works sending out 16,000,000 cu. ft. annually. Twenty per cent. increase in business over year 1895, accomplished through sale of stoves and Welsbach lights. Thirty-seven years old; 21 years in all branches of the gas business. Coal gas works preferred. Reason for desiring change, better school system. Gas Companies and well-known Gas Engineers as references. Salary reasonable. Address

1134-tf "M. L. H.," care this Journal.

FOR SALE.

On account of changing location of our works and purchase of larger holder, we have for sale a Single-lift **Gasholder,** 80 x 20 feet, capacity 100,000 cubic feet. Complete and as good as new. Now in brick tank. Built by Stacey Mfg. Co in 1889. Holder has cup on bottom for telescoping, and guide framing is arranged and punched for additional section. Can be taken down and re-erected in brick or steel tank, as may be desired. Will be sold cheap.

THE AKRON GAS COMPANY,

1129-14t Akron, Ohio.

FOR SALE,

One 8-Foot Station Meter, with 12-Inch Connections.

In good order and in use. Address

1127-tf NEW HAVEN (CONN.) GAS LIGHT CO.

For Sale.

A Small Gas and Electric Light Plant,

in a Southern city of 3,800 inhabitants.

Address FORT WAYNE ELECTRIC CORPORATION,

1097-tf Fort Wayne, Ind.

FOR SALE.

Hydraulic, Dip, Branch and Ascension Pipes, Mouthpieces and Lids, for four Benches of 5's and for one Bench of 3 retorts.
Two Coolers, or Air Condensers, each of 150 000 cubic feet capacity.
Multitubular Condenser, shell, 36 in. diameter, with 98 2-in. tubes, 10 ft. 6 in. long.
D-Shaped Tar Extractor, 8 ft. long, 1 ft. 6 in. deep.
Scrubber, 48 in. diameter, 11 ft. 9 in. high. Three manholes, 11 in. by 15 in.
S-inch Center Seal. Four Purifiers, 8 ft. x 6 ft.

KEY CITY GAS CO.,

1119-tf Dubuque, Iowa.

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A SPECIALTY.

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Consolidated of New Jersey,
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CUSTAVUS MAAS,

Telephone, 2137 Cortlandt. 26 Broad St., N. Y.

MARQUAND & PARMLY,

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(Established 1870.)

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E. H. Nickel Tips for Water Gas a Specialty.

THEO. CLOUGH, - - Dobbs Ferry, N. Y.

Patent Lava Gas Tips.

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ALL SIZES AND SHAPES.

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CHATTANOOGA, TENN.

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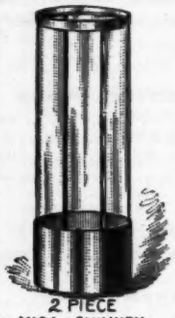

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Etched Chimneys to Order.

For Welsbach Lights
ARE THE
BEST IN THE WORLD.

Get Catalog and Discounts.

The MICA MFG. CO
Micasmiths,
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Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator,

Not Expensive. Write to
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BRISTOL'S RECORDING
PRESSURE GAUGE.
For continuous records of **Street Gas Pressure**
Simple in Construction, Accurate in Operation
Low in Price.
Fully Guaranteed. Send for Circulars.

The Bristol Co.,
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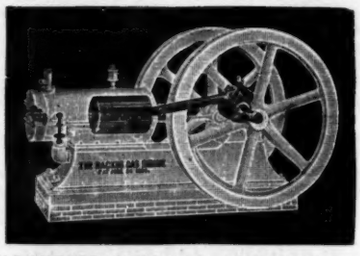

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Home Office, **Backus Water Motor Co.,** Newark, N. J.
Send for Catalogue.

The Pioneer Vertical Water-Tube Boiler of the World!

THE HAZELTON OR PORCUPINE BOILER.

After Sixteen Years of Active Service in all the Principal Industries, this Boiler has Proven Itself Superior to all Others in Economy of Fuel, Durability, Safety and General Efficiency.

NO EXPLOSIONS OR ACCIDENTS OF ANY KIND.

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Sizes from 3 to 75 Horse Power.
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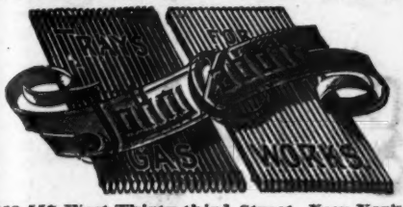
Reversible, Strongest, Most Durable, Most Easily Repaired.



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COKE CARS for Gas Works,
TIP CARS for Carrying Ashes,
CHARGING CARS for Bringing Coal from the Storage Bins to Boiler Room and Retort Houses.

INDUSTRIAL RAILWAYS

Specially designed for handling material in and around

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Their Construction and Arrangement,

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Originally written by SAMUEL HUGHES, C.E.

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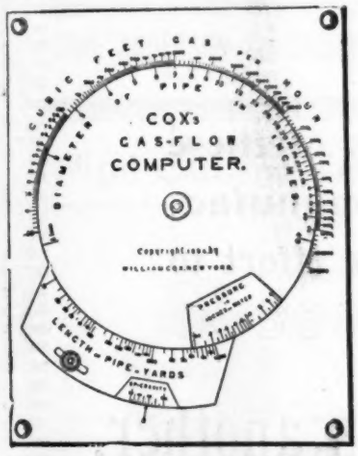

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2. When the required discharge and the length of pipe are given, the diameter corresponding to any pressure is at once seen.
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4. Any suitable combination of the different factors of any problem, under all possible conditions, may be immediately found.

It Prevents Errors and Saves Hours of Tiresome Calculations.

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With Instructions for Care and Working of the Same.

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OUR advertisements, setting forth not only the merits of DETROIT JEWEL GAS RANGES, but also the great advantages to be derived from the use of GAS FOR COOKING, are now appearing in such high-priced advertising mediums as the following:

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EXAMINE the advertising columns of these periodicals, and see if any other manufacturers of gas stoves are making a like effort to popularize the use of gas for fuel.

MORAL: One good turn deserves another.

DETROIT STOVE WORKS,

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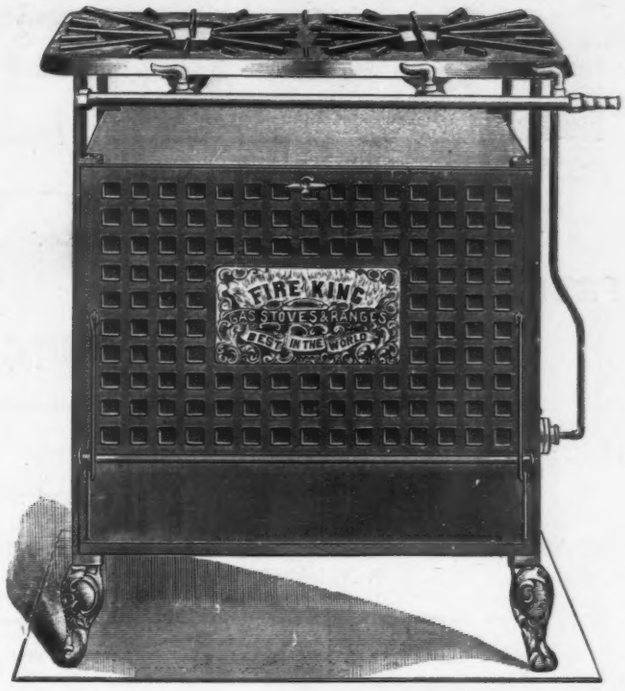
LOW PRICED GAS RANGES.

Just the thing for these Hard Times. Will cook for a large family. Write for catalogue and discounts. A full line of all kinds of Gas Stoves and Ranges.



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Factory: BALTIMORE, MD.

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THE ANDERSON Patent Cutter Carrying Link
Made in all sizes.

Will cut from 2 in. to 24 in.
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For Cutting Cast, Wrought Iron, Gas & Water Pipes.
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SOLE IMPORTER OF THE CELEBRATED
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BLOCKS, TILES, FIREBRICKS, FIRE CEMENT,
Stettin "Anchor" & "Eagle" Brand Portland Cement
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THE GREATEST IMPROVEMENT IN GAS LIGHTING
Has been made by
WILDER'S VOLUMETRIC GOVERNORS.
They control the pressure at the burner, and deliver the quantity for which they are set regardless of high or low pressure in the supply.
WELSBACH LIGHTS are fully controlled, and the governors soon pay for themselves by preventing the breaking of mantles and chimneys. Thousands are already in use. Orders may be given to the Welsbach Co., or sent to ourselves.
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GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

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PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

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Exhausters, Blowers, etc.

Recuperative Furnaces, Washers, Condensers, Purifiers and Purifying Machines, Ammonia Plant, Coke Conveyers, etc,

APPARATUS BY WHICH COAL GAS CAN BE BROUGHT UP TO 22 or 24 CANDLE POWER, MAKING A WHITE LIGHT THAT WILL BURN WITHOUT SMOKING.

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Coal and Water Gas Plants,

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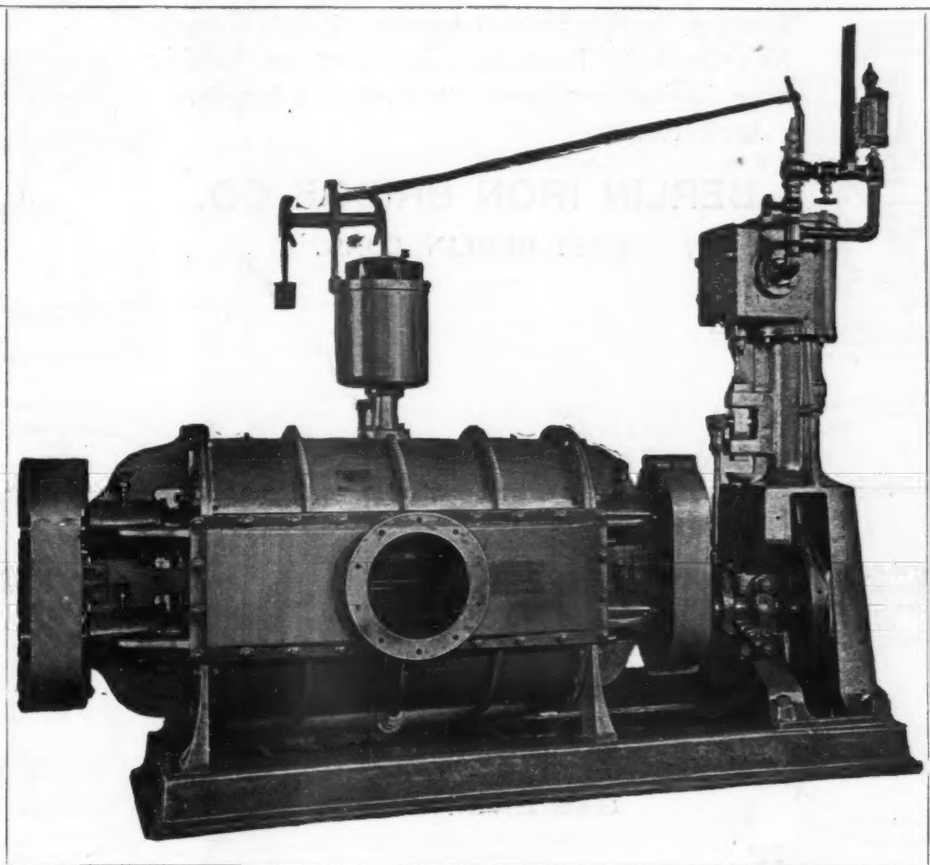
New Design of Direct Connected Engine and Exhauster on Same Bedplate.



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Write for Illustrated Catalogue.
Estimates submitted on application.

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Width, 155 feet (divided into center span of 66 feet, with a wing on each side 43 feet 6 inches). Total length of Building, 350 feet. Designed for an Iron Foundry, but, owing to the failure of purchaser, is now offered for sale at a bargain. Is adapted for a Foundry, Machine Shop, and, with very slight changes, for a Car Barn. Ironwork is as good as new, building never having been used. Will sell at a bargain.

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THE MANAGEMENT OF SMALL GAS WORKS.

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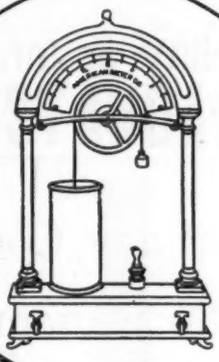

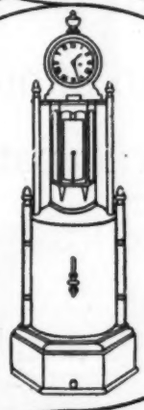

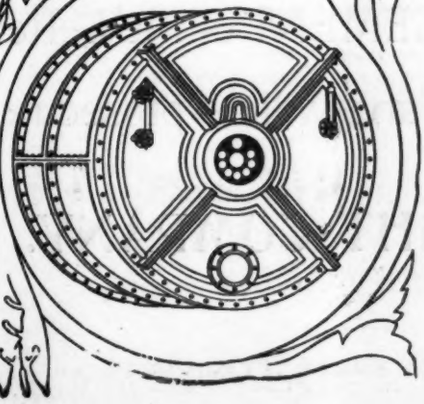

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NEW YORK AND PHILADELPHIA,
CHICAGO, ST. LOUIS,
SAN FRANCISCO.

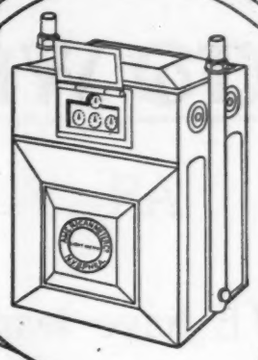
PUBLIC LIGHTING TABLE.

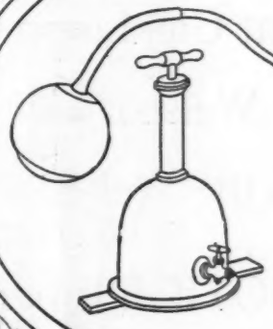
APRIL, 1897.

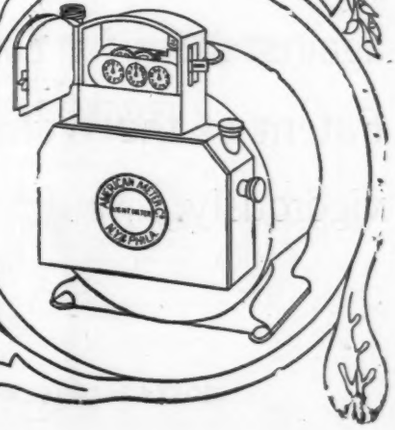
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Thu.	1	6.50 PM NM	4.50 AM	6.10	4.55
Fri.	2	6.50	4.50	6.15	4.40
Sat.	3	6 50	4.50	6.15	4.40
Sun.	4	7.00	4.30	6.15	4.40
Mon.	5	7.00	4.30	6.15	4.40
Tue.	6	10.20	4.30	6.15	4.40
Wed.	7	11.10	4.30	6.15	4.40
Thu.	8	12.00 AM	4.30	6.15	4.40
Fri.	9	12.40 FQ	4.30	6.25	4.30
Sat.	10	1.20	4.30	6.25	4.30
Sun.	11	1.50	4.20	6.25	4.30
Mon.	12	2.10	4.20	6.25	4.30
Tue.	13	2.40	4.20	6.25	4.30
Wed.	14	3.10	4.20	6.25	4.30
Thu.	15	No L.	No L.	6.25	4.30
Fri.	16	No L. FM	No L.	6.30	4.20
Sat.	17	No L.	No L.	6.30	4.20
Sun.	18	7.20 PM	10.00 PM	6.30	4.20
Mon.	19	7.20	11.20	6.30	4.20
Tue.	20	7.20	12.30 AM	6.30	4.20
Wed.	21	7.20	1.20	6.30	4.20
Thu.	22	7.20	2.10	6.30	4.20
Fri.	23	7.20 LQ	2.40	6.40	4.10
Sat.	24	7.20	3.10	6.40	4.10
Sun.	25	7.20	3.30	6.40	4.10
Mon.	26	7.20	3.50	6.40	4.10
Tue.	27	7.20	4.00	6.40	4.10
Wed.	28	7.20	4.00	6.40	4.10
Thu.	29	7.20	4.00	6.40	4.10
Fri.	30	7.20	4.00	6.45	4.00

TOTAL HOURS LIGHTING DURING 1897.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	233.00	January	423.20
February	187.20	February	355.25
March	202.00	March	355.35
April	170.40	April	298.50
May	163.00	May	264.50
June	140.40	June	234.25
July	151.40	July	243.45
August	167.30	August	280.25
September	174.40	September	321.15
October	200.00	October	374.30
November	205.20	November	401.40
December	220.10	December	433.45
Total, yr.	2216.00	Total, yr.	3987.45







To Whom It May Concern.

WE have learned that the makers of the "Sunlight" lamp assert that there has been a decision in the English Courts which saves them and their customers from liability as infringers of the Welsbach patents.

We assure the public there is no decision of any Court, in England or elsewhere, that directly or indirectly warrants the statement or inference that the lamp sold by the Sunlight Incandescent Gas Lamp Company of America is not an infringement of the Welsbach Light as made under the American patents, of which the Welsbach Light Company is sole and exclusive owner.

NOTICE is hereby given to all PURCHASERS and USERS of the so-called "Sunlight" lamp that suits will be brought against them for DAMAGES for INFRINGEMENT of the Letters Patent of the Welsbach Light Company, and will be prosecuted vigorously.

WELSBACH LIGHT COMPANY.

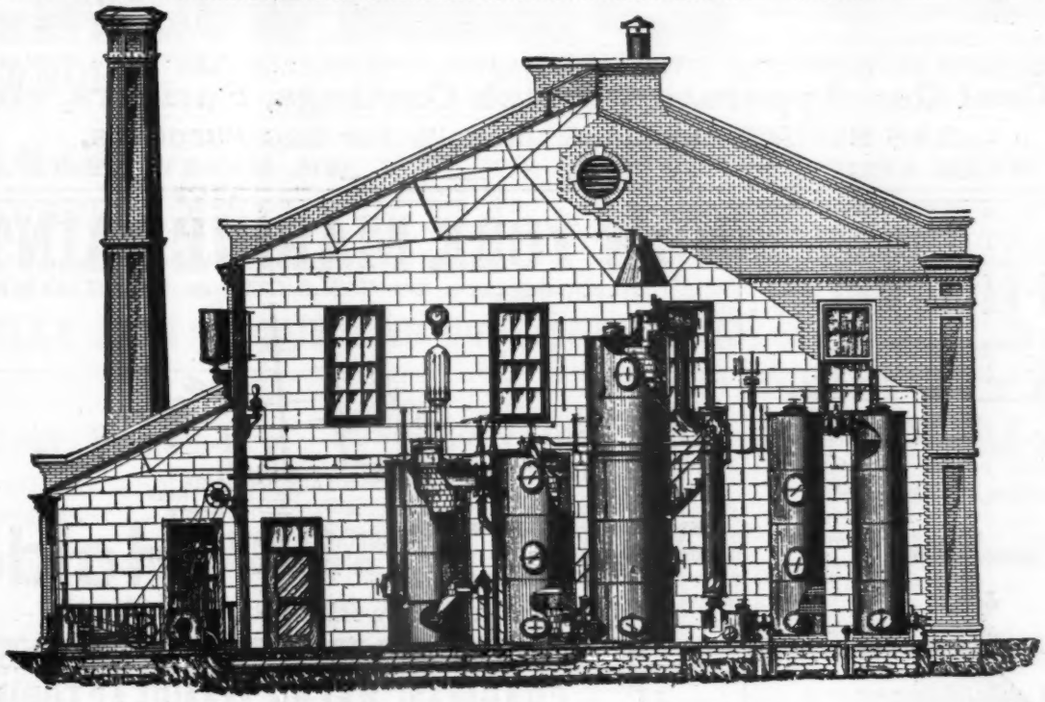
THE UNITED GAS IMPROVEMENT CO.,

DREXEL BUILDING, PHILA., PA.

Inquiries from any part of the United States should be addressed to the Philadelphia Office.

BUILDERS OF

THE STANDARD LOWE WATER GAS APPARATUS.



Standard "Double Superheater" Lowe Apparatus, designed for the use of Naphtha, Crude Oil, or "Distillates."

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Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil, and Anthracite Coal, or Gas House or Oven Coke.

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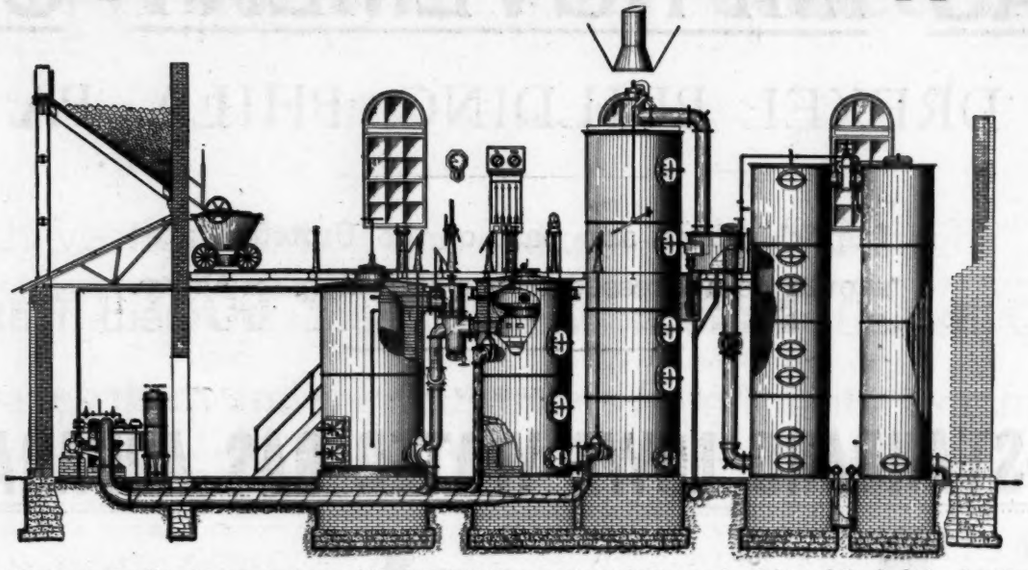
ENGINEERS AND BUILDERS OF GAS WORKS.

The Improved Lowe Water Gas Apparatus.



Improved Double Superheater Lowe Water Gas Apparatus, for use of Crude Oil, Distillates, or Naphtha and Gas House or Oven Cokes, or Anthracite Coals. Results are Guaranteed.

Also, Coal Gas Apparatus, Bench Castings, Purifiers, etc., etc.

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SEND FOR CIRCULAR.

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ALSO,

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And all Ironwork about Gas Works.

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The Gas Engineer's Laboratory Handbook.

By JOHN HORNBY, F.I.C.

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TESTED BY THREE YEARS' PRACTICAL OPERATION, AND FULLY GUARANTEED.

Plans and Estimates Upon Application.

IRWIN REW, President and Treasurer. E. E. MORRELL, Engineer.

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(Successors to CONNELLY & CO.)

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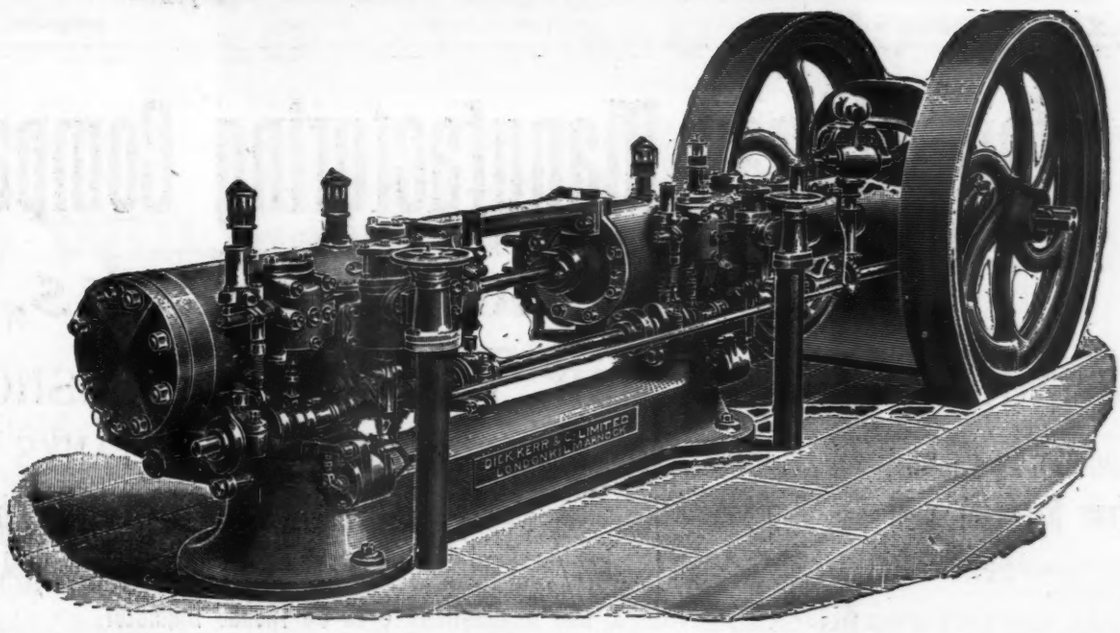

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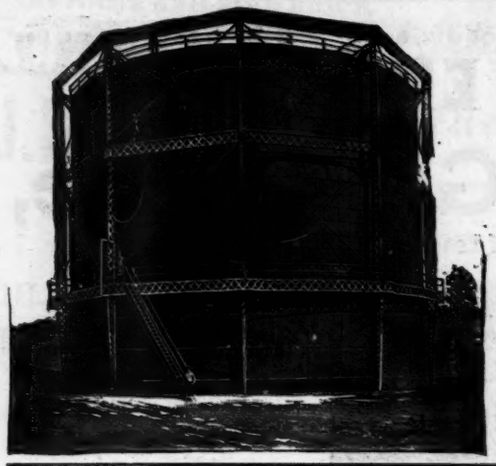

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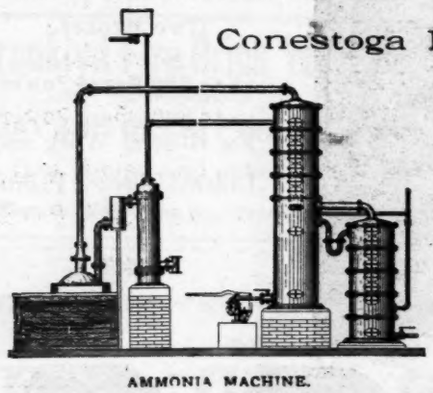

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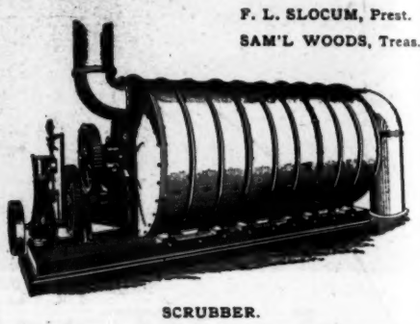

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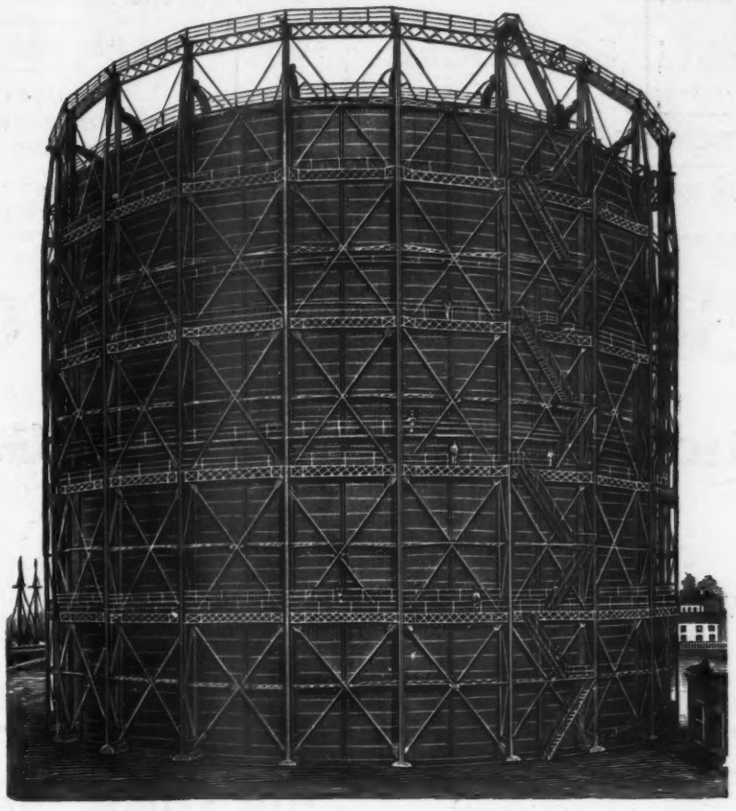

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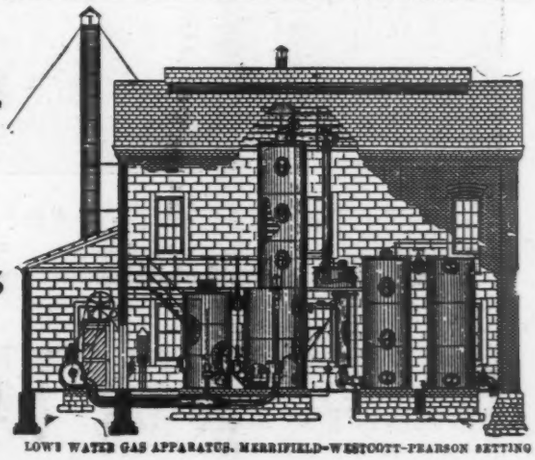

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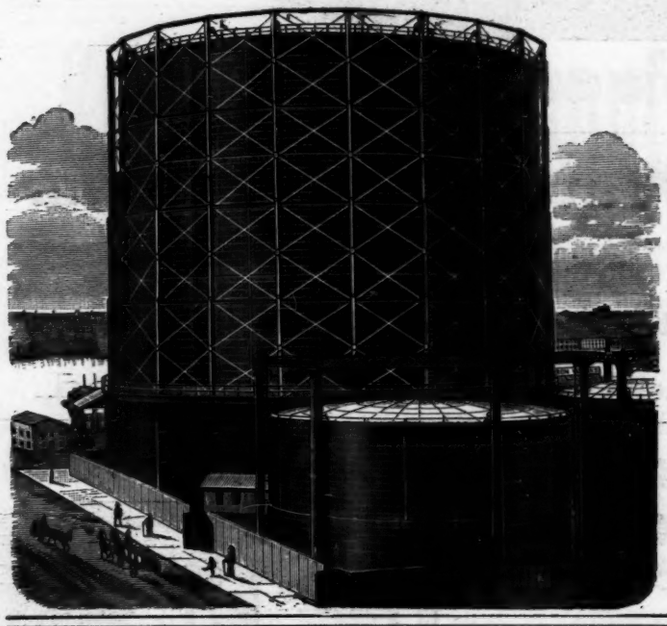

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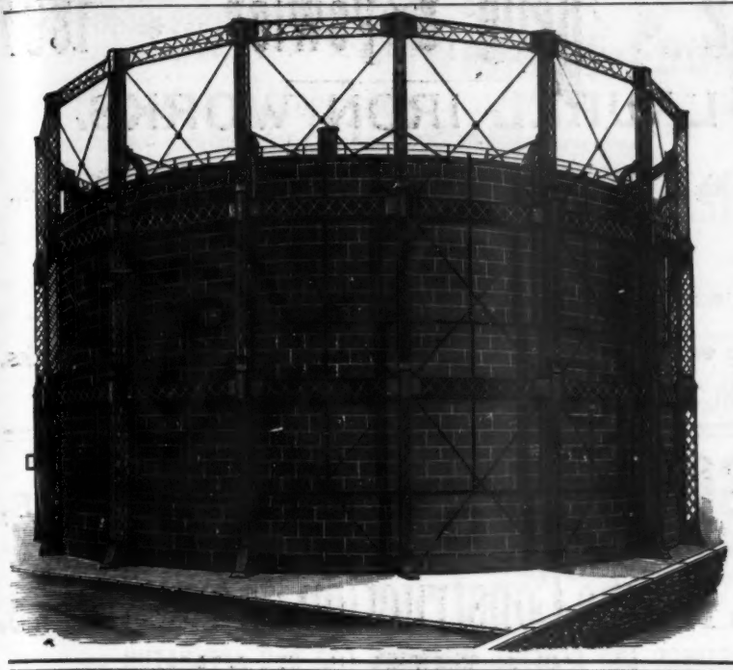

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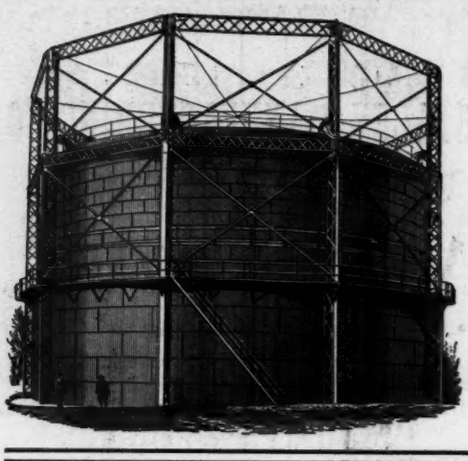

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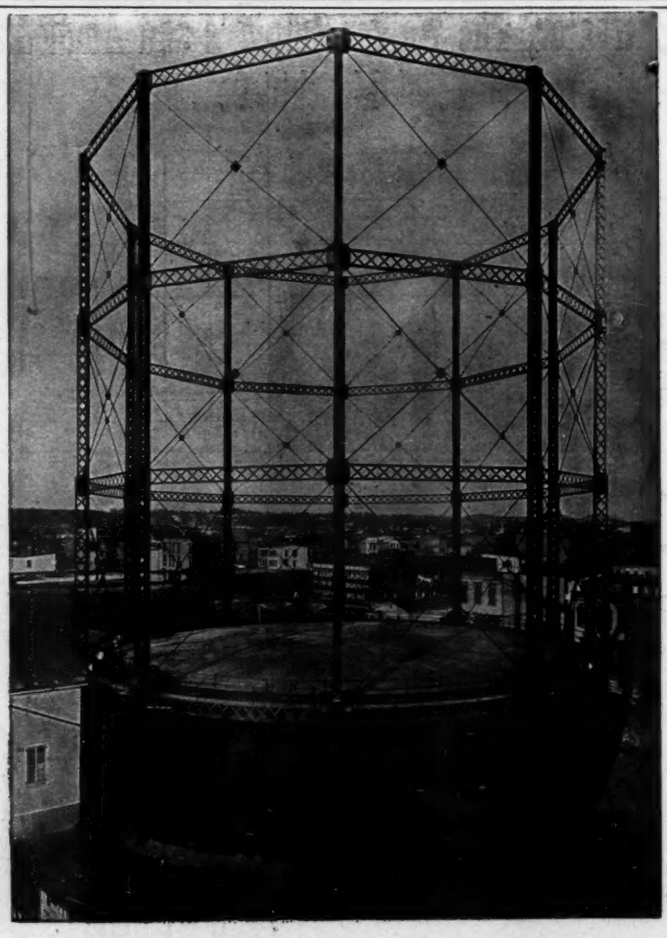

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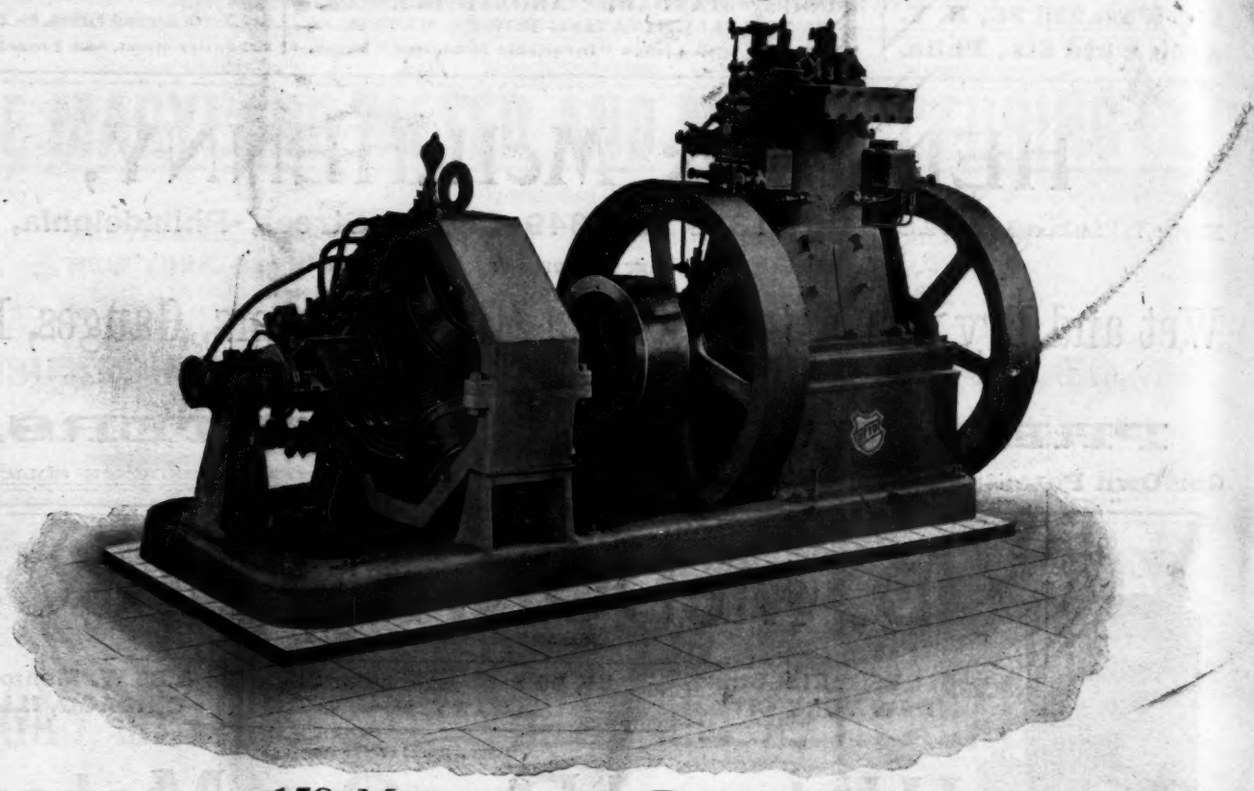

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